FIRST FIVE YEAR REVIEW REPORT

KENNECOTT SOUTH ZONE

OU 1 Bingham Creek
OU 4 Large Bingham Reservoir
OU 5 Copperton Tailings
OU 10 Copperton Soils
OU 11 Bingham Canyon
OU17 Bastian Sink

U. S. Environmental Protection Agency, Region 8
999 18th St, Suite 300
Denver, CO 80202

Utah Department of Environmental Management
168 N 1950 N
Salt Lake City, UT 84116

Approved By: _____
Max H. Dodson
Assistant Regional Administrator
Office of Environmental Protection and Remediation

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TABLE OF CONTENTS

APPENDIX E: Excerpts from ARCO Final Report for Bingham Channel cleanup
APPENDIX F: Excerpts from Kennecott Ground Water Protection Permits
APPENDIX G: Results of Chemical Analyses, Bingham Creek OU1
APPENDIX H: Kennecott Inspection Checklists for Bingham Reservoirs
APPENDIX I: Excerpts from ARCO Final Report for Copperton Tailings Operations and Maintenance and monitoring

FIRST FIVE YEAR REVIEW
BINGHAM CREEK AND NEARBY FACILITIES
KENNECOTT SOUTH ZONE
OU's 1, 4, 5, 10, 11, 17

I. INTRODUCTION

A. Five Year Review Committee

The Five Year Review for OU's 1, 4, 5, 10, 11, and 17 of the South Zone cleanups was conducted as a joint project of EPA Region VIII (Eva Hoffman, Lead RPM), Utah Department of Environmental Quality (Doug Bacon, state project manager), and the City of West Jordan (David Murphy, Engineering, Department of Public Works). A committee was formed composed of individuals knowledgeable about the cleanups. Some of these participants were involved in the actual cleanups which began around 1991. These participants aided the EPA/State/City Five Year Review Team in inspecting the sites, in locating monitoring data and in evaluating the success of the various cleanups.

The advisory group included the following:

Steve Way, EPA, original OSC for the Bingham Creek cleanups;
Ronald Segura, Bureau of Reclamation, original on-site characterization and oversight staff;
Jon Cherry, Kennecott, project engineer for OU's 1, 4, and 11;
Brian Vinton, North American Mine Services, a Kennecott contractor now and at the time of the original cleanups;
Steve Anderson, Anderson Engineering, ARCO's prime contractor for the Bingham Creek (OU1) and Anaconda Tailings (OU 5) cleanups;
Neil Ferrell, Anderson Engineering, Operations and Maintenance leader for OU 5;
Pam Kaye, current ARCO Project Manager for OU 1 and OU 5;
David Murphy, City of West Jordan, Public Works, Engineering;
Gerry Robinson, City of West Jordan, Public Works, Manager of the city stormwater management wetlands project.

B. Objectives of the Five Year Review

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, requires Five Year Reviews. CERCLA §121(c) states the following: "If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than five years after the initiation of such remedial action to assure that

human health and the environment are being protected by the remedial action being implemented."

EPA guidance (OSWER No. 9355.7-03B-P, June 2001) indicates that Five Year Reviews are conducted as a matter of national policy if the site is "a removal action only site on the NPL [National Priorities List] where a removal action leaves hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure and where no remedial action has or will take place."

In this particular case, cleanups began in and along Bingham Creek (Kennecott South Zone OU1) in 1991 as a removal action. Concurrently, EPA began negotiations with Kennecott and ARCO, the major PRPs at the site, on a then-novel concept involving cleaning up mining wastes without listing the site on the NPL. In order to streamline the responses, most of the cleanups at the site were performed using removal authorities of CERCLA, under the provisions of Administrative Orders on Consent (AOCs) or Unilateral Administrative Orders (UAOs). Later, to demonstrate that the removal actions had achieved final cleanup objectives, an Institutional Controls only Record of Decision was issued for OU's 1, 4, 5, 10, 11, and 17 by EPA and the State of Utah in September, 1998. This approach was called at the time an Enforcement Pilot. More recently, sites where this approach has been used have been called non-NPL sites, NPL-equivalent, NPL-alternative sites or Superfund Alternative Sites (SAS). EPA guidance for Five Year Reviews does not mention these type of sites. (Guidance does suggest that "the Five Year Review is independent of and unaffected by deletion process.")

One of the principal concepts used by EPA Region VIII and the State of Utah for management of these cleanups was that the responses would be equivalent to the responses which would have been required had the site been listed on the NPL. This concept included quality of the cleanups, risk assessments, and community involvement. In all cases, the requirements of CERCLA and the NCP for response at NPL sites was achieved or exceeded. There was a strong commitment to community involvement. Although there is no national policy on how NPL-alternative sites should be handled vis-a-vis the Five Year Reviews, EPA Region VIII has decided that for the Kennecott North and South Zone sites, Five Year Reviews are relevant and appropriate given the size and complexity of the site and the cleanups. Notwithstanding the fact that the Kennecott North and South Zone sites are NOT on the NPL, EPA Region VIII will conduct Five Year Reviews for this site in an ongoing commitment to maintain parallelism with NPL listed sites in EPA Region VIII. Wastes were left in place at OU's 1, 5, 10, 11, and 17. OU 4 is an operational facility which continues to handle hazardous materials. For this reason, these OU's underwent a

Five Year Review to maintain parallelism with NPL sites in the Region.

Although the Five Year Review does not mention impacts of the cleanups on the economic enterprise of the affected communities, this examination of changes at the site gave EPA, UDEQ, and the City an opportunity to determine if the stigma of the cleanup or the presence of buried wastes have impacted the community's commerce. Although this objective is not included as an objective in the CERCLA statute, it is included a part of the on-going enhanced community involvement pilot project conducted at the site.

C. Scope of this First Five Year Review Report

The Kennecott Sites, Kennecott North Zone and Kennecott South Zone, were divided into 24 operable units (OU's). Later, two of the operable units were deleted because they were not owned by Kennecott and, after characterization, were addressed as separate sites (Old Cobalt Ponds Removal Action and International Smelter and Refining NPL Site, OU's 20 and 21). A summary of the Operable Units and their status is given as follows:

Areas	OU's	Five Year trigger date	Date of First Five Year Review
South Zone, Bingham Creek area	1, 4, 5, 10, 11, 17	Institutional Controls only ROD, Sept.1998	June, 2004
South Zone, Butterfield Creek area	3, 6, 7	Institutional Controls, RA Start, Jan, 2003	Jan. 2008*
South Zone, SW Jordan Valley ground water plumes	2, 12, 16	Pump and treat, RA start, Sept 2004	Sept 2009
North and South Zone operational areas	8, 9, 13, 14, 15, 18, 19, 22, 23, 24	Ground water treatment, demolition, IC's, RA start, Sept 2004	Sept 2009

* may be rescheduled to coincide with other site Five Year Reviews

D. Methods Used

This Five Year Review was conducted by first listing the changes which could have occurred at the site since the original removals were conducted and then evaluating if the changes took place and if so, did these changes result in

possible impairment of the remedies. The changes included changes of land use, changes due to weathering, and changes due to construction activities. To determine if the remedies remained effective in protecting human health and the environment, each operable unit was visited and appropriate records inspected. Where it was suspected that hazardous substances might have been uncovered, new samples were collected to assure that construction activities had not inadvertently caused disturbance of the hazardous substances. Kennecott and ARCO participants aided in the location of monitoring records. All the property owners where new samples were needed granted access.

E. Community Interviews

In-person community interviews for the Bingham Creek Five-Year Review were conducted in the Salt Lake Valley Monday, July 23, 2003, through Wednesday, July 30, 2003. The interviews were conducted by Dave Allison of the Utah Department of Environmental Quality, and Britta Campbell and Nancy Mueller of Region 8 of the Environmental Protection Agency. Residential property owners and municipal officials were interviewed. Community interviews focused mainly on Bingham Creek OU1, because the other operable units either required no action or were remote from nearby communities. (The results of the community interviews are given in Appendix A.)

An announcement that EPA was conducting a Five Year Review appeared in both daily newspapers (Salt Lake Tribune and Deseret News) on July 21, 2003 (See Appendix B).

II. BINGHAM CREEK - OU1

A. Background

a. Bingham Creek Channel: The Bingham Creek Channel consists of the current and historic channel course of Bingham Creek from the Large Bingham Reservoir in the foothills of the Oquirrh Mountains on the west to the Brookside Mobile Home Park in the City of West Jordan on the east, a distance of about 9 miles. The creek course at the Large Bingham Reservoir is located along the western side of unincorporated Salt Lake County near the town of Copperton, then travels easterly through the Cities of South Jordan and West Jordan.

The channel transects an eastward, gently-sloping alluvial plain that extends from the foot of the Oquirrh Mountains front to the Jordan River. The elevation ranges from 5300 feet (ASL) at the Large Bingham Reservoir to 4300 feet at the confluence of the creek with the Jordan River.

The upper part of the creek channel is located on private land used for farming, mining, and industrial purposes. Portions of the lower part of the creek channel are located on public lands used for open space and recreation, but is bounded by suburban residential, commercial and industrial development. Other portions of the creek channel are located on privately owned residential property. In some cases, the creek has been rerouted in man-made ditches, channels, and culverts with suburban development occurring on the historic channel.

Bingham Creek is an intermittent, losing stream that flows only during peak runoff periods or during major storm events. The channel course, over time, has meandered and overflowed during flood events that have been caused by natural and human-caused events. Historically, the creek has abandoned old channels and formed new channels spreading contaminated alluvial and waste materials across broad areas. The principal aquifer under the creek is recharged along the foothills of the Oquirrh Mountains and discharges downgradient at the Jordan River. Groundwater is being addressed as part of another operable unit (OU2).

b. Bingham Creek Residential Soils: The Bingham Creek Residential Soils area consists of certain residential development areas in the floodplain of Bingham Creek. Located in the cities of South Jordan and West Jordan, numerous residences were built on the floodplain or over historic channels. Since most of the historic flow of the creek was diverted by early farmers and ranchers, some creek-borne contaminants were also found near irrigation ditches. Neighborhoods affected include Jordan View Estates, Meadow Green, Fahnian Ranchettes, Vista West, Sugar Factory, and Brookside. Approximately 125 individual residences were addressed as part of three prior removal actions. Most of these residences were located within 2 blocks of the creek channel.

c. Lower Bingham Creek: Lower Bingham Creek is the section of the creek between the Brookside Mobile Home Park on the west and the creek's confluence with the Jordan River on the east a distance of about a mile. This section is located in the historic Jordan River floodplain and is relatively flat. The creek courses through industrial and agricultural lands here. On the west, the creek is buried in a culvert underneath a light industrial park with associated parking lots. From the industrial park on 1300 W. the creek flows through agricultural and ranch land to about 1250 W, where it has been diverted into a new man-made channel directly to the Jordan River. The land near the channel is used for agriculture (currently, alfalfa). A minimum flow in the old channel is maintained by a diversion structure. The old channel abuts an asphalt plant and a wetland area used by the city to treat stormwater from 7800 S. Bingham Creek water does not enter this wetland. The nearest residences are about 2 blocks away. There is a small flow in the creek through this section originating with some springs at the

Brookside Mobile Home Park and overflows from an irrigation canal near the Jordan River. There is a Brownfields proposal to use a portion of this land as a recreational corridor with bike paths and trails.

B. Chronology

DATE	ACTIVITY
August 1990	PA/SI at Bingham Creek
May 1991	Action Memo, Phase 1, removal action at residential areas along Bingham Creek, Fund-lead, excavate contaminated soils down to depth of 18" and replace with clean fill.
May 1991	AOC, CERCLA-VIII-91-11, Kennecott agrees to build a soils repository and haul the excavated soils to their repository
December 1991	Completion of Phase 1 removal, cleanup of 52 residences. The interim removal action level is 2500 ppm lead in soils.
January 1993	Action Memo, Phase 2, cleanup of the Bingham Creek Channel
February 1993	UAOs issued to Kennecott and ARCO, CERCLA-VIII-93-10, removal of top 3 feet or more of contaminated sediments, haul contaminated sediments to repositories, regrade and revegetate channel.
December 1995	Completion of Phase 2 removal. The removal action level is 2000 ppm lead in sediments
June 1995	Action Memo, Phase 3, cleanup of remainder of residences along Bingham Creek using final action level of 1100 ppm lead in soils
July 1995	UAO issued to ARCO, CERCLA-VIII- 95-19, excavation of contaminated soils down to maximum depth of 18", removal of soils to ARCO's repository, regrade with fill, revegetate with sod for residences.
Dec 1997	Completion of Phase 3 removal. The removal action level (final) was 1100 ppm lead in soils
September 1998	Record of Decision, No Further Action Required
December 1998	RD/RA Consent Decrees with Kennecott and ARCO

DATE	ACTIVITY
Aug 1998 - present	Institutional controls administered through West Jordan Public Works Dept. and building permit program.
May, 2003	Site Inspection for Five Year Review

C. Remedy

a. Bingham Creek Channel: The removal action for the Bingham Creek channel extended from the Kennecott Large Bingham Reservoir dam to the downstream side of the Brookside Trailer Park, a channel distance of approximately nine miles. The work was conducted by ARCO and Kennecott under the supervision of EPA and UDEQ. In general, wastes in the creek channel containing over 2,000 mg/kg lead were removed down to three feet or deeper, any remaining contamination was capped, and the creek bed was then recontoured. The excavated wastes were hauled either to the Kennecott Bluewater Repository or to the Anaconda Tailings.

In the process of cleaning up the creek channel, a number of road crossings and utility corridors were encountered and cleaned up: West Valley Highway Crossing, Kern River Gas Transmission Co. Pipeline Crossing (under provisions of Administrative Order on Consent, CERCLA VIII 92-01), 3200 West Street Crossing, and Salt Lake County Water Conservancy District Water Pipeline Crossing. A number of historic facilities and waste storage locations were also encountered and cleaned up: Tailwater Ditches, Bingham Flats, Evaporation Ponds Canals, Cemetery Pond, Mixed Tails, Robbe Cells, McGregor Precipitation Plant, New York and Utah Mill, Revere Smelter, Holy Cross Hospital Grounds [now Jordan Valley Hospital], and the Redwood Road Pond.

b. Bingham Creek Residential Removal: During Bingham Creek Phase I, in 1991, surface soils contaminated with mining wastes were excavated and removed from 50 residential properties in West Jordan which were located within the historic flood plain of Bingham Creek in accordance with the Action Memorandum dated May 1991. Lead values up to 12,000 mg/kg were found in the soils. Soils with lead concentrations exceeding 2,500 mg/kg were removed and replaced with clean fill. EPA conducted the removal in conjunction with Kennecott. Kennecott participated by constructing a mine waste repository (Bluewater Repository) and providing hauling services from the site to the repository. Their participation was done under the provisions of an Administrative Order On Consent, Docket No. CERCLA-VIII-91-11, dated May

20, 1991. Kennecott also paid EPA a portion of the costs associated with this action.

Bingham Creek Phase III occurred in 1995-1997 and addressed 75 residential properties in accordance with the Action Memorandum dated June 1995. It provided for the removal of soils which had concentrations in the soil exceeding 1,100 mg/kg lead and/or 100 mg/kg arsenic. Removal depths in both actions were as much as 18 inches which was then replaced with clean soil. The removal took place in areas which were determined to provide a pathway for exposure to residents. In Phase III, the work was conducted by ARCO under the provisions of Unilateral Order CERCLA VIII-95-19 dated July 21, 1995, and amended October 31, 1995. The work was conducted under supervision of EPA and UDEQ. The contaminated materials were hauled to the Anaconda Tailings.

c. Lower Bingham Creek: It is known that mining wastes washed all the way from Bingham Canyon to the Jordan River. UDEQ, Kennecott, and EPA have all confirmed that elevated lead and arsenic are found along the creek channel. This area, located in the Jordan River floodplain, is used for agriculture, ranching, and industry. At the time of the Record of Decision, there were no plans to develop this area for residential use. Therefore, the data concerning the location of mining waste contamination were transferred to the City of West Jordan who will manage this area in the future through land use planning, zoning, and building permit authorities. The city has received a Brownfields Grant to design a long-term plan for this and nearby areas.

D. O + M Strategy

The Cities of West Jordan and South Jordan have agreed to supervise long term management of the site using existing authorities for land use planning, zoning, and building permits. For the creek channel portions, EPA and ARCO personnel inspected the channel annually to determine if disturbances have taken place leading to erosion of the cap or exposure of the wastes.

It was during the annual inspection exercise that EPA and the City were notified that construction activities had exposed waste (Mountain View Townhomes). Certain areas of the creek were prone to clogging due to trash buildup.

During the annual inspection in 1998, participants noticed that the Trans Jordan Landfill staff were building a new access road in an area adjacent to the creek channel just east of Rt. 111 and north of the landfill. In one area, the earthmoving activities had re-exposed tailings which were clearly visible in the disturbed soils. At the request of EPA and with the help of Kennecott, the landfill

management and staff repaired the damaged cap along the new access road.

In the future, the channel itself will be inspected by EPA contractors (on an annual basis). Responsibility for repairs to the channel will fall to the Salt Lake County Flood Control District who has recently denied access to ARCO contractors for this purpose. Also the Consent Decree with ARCO only requires that they maintain the channel work for the first five years.

E. Site Inspection Observations

In a site inspection, the committee and the advisory group evaluated the Bingham Creek cleanup areas to determine if there were possible damages to the remedies by (1) changes in land use; (2) changes in the topography of the site due to construction; (3) changes in the topography due to erosion; and/or (4) changes in conditions which are different than those assumed during the design of the remedies. (See Appendix C.) The site inspection participants observed the following changes:

1. The cap covering the wastes in Bingham Creek Channel was experiencing erosional degradation at one location near Route 111 and the Trans Jordan Landfill. Although the erosion gully had not yet gotten deep enough to uncover the tailings, it was clear that this would be inevitable without intervention of some kind. In all other locations, the cap was undisturbed by erosion. (This erosion gully was filled in by a joint action by the Trans Jordan Landfill, the City of South Jordan, and Kennecott. The runoff water is now diverted to a pipe which carries the water underground to the channel. See Appendix D.)

2. There were several changes of land use and construction projects along the edge of Bingham Creek and on the former Bingham Creek floodplain which might have disturbed the cap covering wastes at these locations. In some cases, the City required analytical data from the developer to prove that the cap had not been disturbed or had been replaced after construction. In other cases, the construction plans were designed to avoid such disturbances. Nonetheless, the inspection team recommended that some samples be collected to assure the parties that these disturbances had been minimal. (See also Appendix G.)

   The major developments along the creek were listed for the Review participants by the City of West Jordan. They include:

Color Photo(s)

The following pages contain color that does not appear in the scanned images.

To view the actual images, please contact the Superfund Records Center at (303) 312-6473.

Figure 1: The Woods at Creekview. New construction and landscaping comes right up to the creek channel

Figure 2: Mountain View Business Park, pad construction on top of the remedy

a. Marketplace at Naylor Farm (4000 W 9000 S)
b. Salt Lake Community College (3600 W 9000 S)
c. Jordan Valley Hospital Expansions (3600 W 9000 S)
d. The Woods at Creekview (3200 W 8800 S)
e. Ten-inch waterline for Cascade Springs Apts 8600 S
f. Cascade Springs Apts. (8600 S 280 0W)
g. Mountain View Business Park (8600 S 2900 W)
h. Mountain View Townhomes (8550S 2700 W)
i. Bingham Creek Storm Drain 2700 W to 2200 W
j. Duplexes on Sugar Factory Rd at 2300 W
k. SL County Youth Justice Center (2200 W Sugar Factory Rd.)
l. Sugar Creek Condos (1900 W Sugar Factory)
m. Sanitary sewer line along 1240 W (8050 S - 8150S)
n. SL County Flood Control, new creek channel near Jordan River
o. West Jordan City constructed wetlands near river

Figure 3: Newly reconstructed Bingham Creek Channel in front of the Cascade Springs Apartments

Figure 4: The fence line of the next Sugar Creek Condos abuts on the creek channel

Figure 5: New Bingham Creek Channel near the Jordan River

Figure 6: Diversion structure between old and new channels

The inspection team visited each of these sites. While it was clear that there had been some disturbances due to the construction, no visible tailings were evident. (See sampling results for further information about this.)

3. Some of the conditions influencing the design of the remedy had changed leading to additional waters in Bingham Creek. The additional waters are largely coming from increased development in the general area and diversion of the stormwaters from these areas to Bingham Creek. The team observed that the City and County had compensated for these additional flows by providing another outlet for the creek waters into the Jordan River and by constructing an artificial wetland to treat urban runoff in an area adjacent to the creek. The new wetlands appear to work as they were designed. Also in order to accommodate the additional flow, several culverts under roads and through developments had been replaced with culverts having a larger capacity.

4. With very few exceptions, the revegetation efforts along the creek channel, in the residential neighborhoods, and in the new developments are in excellent shape. It is difficult to see that the area had ever been disturbed by the cleanups. In many cases, the vegetation is healthier than was there before the cleanups.

Figure 7: Revegetation of Bingham Creek

Figure 8: Revegetation of Bingham Creek Channel

Figure 9: Revegetation of Creek Channel

5. The site inspection team noticed that the artificial wetland project has changed the usage of that area somewhat. The original land use was agricultural and now the area is a water treatment/wildlife habitat area. Adjacent to the new wetlands is the older Bingham Creek channel. The southern bank of the old channel is now riddled with bird and animal burrows along the face. The bird burrows were in active use at the time of the visit. Participants have noted that coyotes have used the animal burrows in the past. None of these burrows were present at the time of the ROD. The section of the creek affected is about 100 linear feet. The state collected soil samples from the banks in the area of the burrows. It did not appear than animals had burrowed through the cap on the top. Although the area is not closed to the public, access to the cliff with the burrows would be difficult because of the steep slope. There is a bike trail parking lot directly across the river from the wetland and the trail has a bridge crossing toward the wetlands. The trail abuts the wetlands on the eastern side, but does not go through the wetlands. The land use should be considered as wetland habitat for ecological considerations, and recreational/educational for human health exposures. The State may sample this bank in the future.

6. The site inspection team visited the repositories where the mining wastes had been placed during the remediation. For the Kennecott projects, two waste repositories were built in the Bluewater I drainage. The repositories were created by excavating alluvium down to bedrock and then using the alluvium later as a cap. Only wastes which did not leach lead and arsenic were allowed in the repository. The Bluewater North Repository is now closed, capped, and revegetated. The Bluewater Main Repository is only partially filled and is still open for use by developers along Bingham Creek (case-by-case basis) and by developers in Herriman. Each repository has a sump and downgradient ground water wells which are under the supervision of the Utah Division of Water Quality through Kennecott's Bingham Canyon Mine and Leach Collection System Permit (UGW 350010). There are quarterly and annual reports. The cap was holding up well and there was no evidence of erosion of either the closed or the open repository. (See Appendix F.)

   ARCO consolidated their Bingham Creek excavated wastes with the Anaconda Tailings. After completion of the Bingham Creek action, ARCO capped the Anaconda Tailings and the Bingham

Creek excavated soils in the same repository. (See Anaconda Tailings - OU 5)

F. Changes in ARARs or Risk Assessment Science

There have been a few advances in the general knowledge concerning risk assessment methodology since the Bingham Creek clean ups began. A comparison between the action levels used at Bingham Creek and later calculations which produced site-wide cleanup goals to be used site-wide is given in the following table:

LAND USE	ORIGINAL BINGHAM CREEK ACTION LEVEL FOR LEAD[1]	ORIGINAL HERRIMAN ACTION LEVEL FOR LEAD[2]	SITE WIDE ACTION LEVEL FOR LEAD [3]
residential, unrestricted	1100 ppm, site specific	1200 ppm, site specific	500 ppm, generic
residential, risk assessment range	1100 - 1500 ppm, site specific	1200 - 1600 ppm, site specific	500 ppm, generic
industrial/commercial	not calculated	1,500 ppm, generic; 4000 ppm, site specific	4414 ppm, generic
agricultural/open space	not calculated	10,000 ppm, site specific	8500 ppm, generic
recreational (ATV)	2000 ppm, site specific	1,500 ppm, generic; 4000 site specific	2207 ppm, generic

[1]From the Bingham Creek ROD, Sept., 1998, also includes the Copperton Tailings site.

[2]From the Kennecott South Zone OU 3, 6, 7 ROD, Sept., 2001, exposure assumptions nearly identical to Bingham Creek.

[3]From the Kennecott North Zone ROD, Sept, 2002

Note: The site-specific values include site-specific bioavailability assumptions; the generic values assume a default value of 100% bioavailability and are used when the bioavailability is unknown.

As suggested by the above table, the site-specific residential action

concentrations relevant to Bingham Creek have not changed substantively since the removal actions along Bingham Creek were performed. In addition, the later concentrations generated for non-residential land use are very similar to the original action level used for the Bingham Creek channel. The channel land use was assumed to be open space and recreational at the time the action was taken. Therefore, EPA has not found it necessary to revise the original Bingham Creek action levels in order to remain protection of human health.

G. Records Inspection

Each year, ARCO contractors inspected the creek channel portions that they had remediated. They included their findings and photographs in each annual report. The final annual report (December, 2002) included the following observations and actions:

1. The inspector noted that a large new underground conduit had been constructed between 2500 W and 2200 W.

2. Vegetation continued to flourish, except where a resident had placed an obstruction in the creek to create a duck pond. The ducks destroyed the vegetation along the banks and in the channel.

3. Channel banks were repaired at flow structures. The damages were usually caused either by unauthorized weirs or trash buildup on the structure.

4. The flow structures were in good condition with the exception of Structure 17 in the area of the unauthorized duck pond. The change in flow dynamics has caused undercutting of the apron of the structure (about 6 feet from the structure itself).

5. The final annual report indicated that the Salt Lake County Flood Control would not be approving any further O+M repairs in Bingham Creek "until the channel design has been upgraded to the present design flow." (See Appendix E.)

Kennecott has kept monitoring records with regard to sump waters and ground water at the Bluewater Repositories which hold the wastes from the Kennecott projects along Bingham Creek. The records are included in the annual Ground Water Permit report. The waters collected from the ground water wells downgradient of the Bluewater North Repository were stable with regard to most components but were steadily increasing in sulfate and magnesium

concentrations. Zinc concentrations were decreasing. Water levels in the wells dropped 10 - 15 feet since the repository was installed, but has rebounded by half in the past two years. Kennecott thought that the water level drop timing was coincidental with the installation of the Bingham Creek Cutoff Wall (part of the leachate collection system) and thus may be more related to activities there than any impact of the repository. The waters collected from the ground water wells downgradient of the Bluewater Main Repository have shown a slight depression of pH. Water levels there rose 15 feet in 1998, but have begun a slow but steady decline since then.

Water quality and volumes of the sump waters from the two repositories were also reported in the Ground Water Permit annual report. The sumps both collect water mainly in the spring each year. The sumps associated with the repository collect water from the gravel layer between the wastes and the bedrock. Water quality is generally poor and varies widely, especially in TDS, sulfate, and magnesium. At the Bluewater Main Repository Sump, there was an unexplained spike in the concentrations of copper, cadmium and chloride in the spring of 1998. Yet for this sump, lead concentrations were always beneath the detection limit (50 ppb) and the highest arsenic concentration was 12 ppb. At the Bluewater North Repository Sump, there was an unexplained spike in copper, zinc, TDS, magnesium, and sulfate in the winter of 1993. This was coincidental with the beginning of construction of the cut off walls in this area and flushing of leachate through the area's alluvium. Lead concentrations in the sump waters were again beneath detection and the maximum arsenic (2001) was 57 ppb, typically 0 - 25 ppb arsenic. Kennecott theorizes that the source of the water in the sumps is not solely water that percolates through the wastes in the repository, but also includes water infiltrating into the french drain system from the surrounding alluvium or even from the bedrock aquifer.

The wells and sumps associated with the soil repositories do not show evidence of lead and arsenic releases to ground water. Rather, the wells and sumps probably better reflect the conditions in the surrounding area. The repositories are both located within Kennecott's leach collection system which would trap any releases if they occurred. (See Appendix F.)

ARCO took their excavated wastes from their Bingham Creek projects and consolidated them with their ARCO Tailings site (OU5). Monitoring and maintenance information for this area is included in their annual report. The records associated with this area are discussed in the ARCO Tailings (OU5) section of this report.

H. Post Construction Sampling required by the City

In conjunction with several public works projects funded partly by the City of West Jordan, and with several private developments along the creek, the City required submittal of post construction surface sampling results to confirm that no wastes were encountered, or that any wastes exposed during construction were reburied or removed from the site.

At the West Jordan City constructed wetlands (SE of the rail crossing of 7800 S), the city had characterized the site at depth prior to excavation of the wetland ponds. The site, located just north of the old Bingham Creek Channel, is adjacent to the Jordan River and the Jordan River recreational corridor (bike paths, pedestrian bridge). Using the sampling information, the excavated contaminated soils were stockpiled along the periphery of the ponds. These piles were then re-sampled to determine what disposal technique should be used. There were 13 stockpiles: 4 with lead concentration > 500 ppm; 1 with lead between 200 and 500 ppm; 1 with lead between 128 and 199 ppm; and 7 with lead concentrations < 128 ppm. The action levels for lead hotspot (<2 cy) removal was 1000 ppm lead; for larger areas, removal offsite was set at 500 ppm lead. These values led to cleanups with more stringent requirements than used in the original cleanups. This area was NOT cleaned up during the Bingham Creek responses because the land use was either agricultural or industrial. The ROD indicates that the future land use might be recreational because the bike path along the Jordan River was being planned at the time. Note: it was assumed that the majority of the lead in this area originated with Bingham Creek, but there are other possibilities as well due to its location in the Jordan River floodplain with nearby historic smelter and milling sites. The site was cleaned up in the process of constructing the wetlands and it now suitable for unrestricted use. However, adjacent to the wetlands is the original Bingham Creek channel and the tailings are still present under the surface. The land use in this area, agricultural land, at the time of the Record of Decision remains unchanged.

The City of West Jordan required sampling of the proposed alignment of the sanitary sewer line along 1240 W between 8050 S and 8250 S. This is in an area of lower Bingham Creek which was used for agriculture at the time of the ROD, and is still in agricultural use. Eight locations were sampled by digging test pits. At two locations, high concentrations of lead (14,000 ppm and 11,000 ppm) and arsenic (240 ppm and 230 ppm) were found 1 1/2 to 2 feet beneath the surface. The consultants suggested that any soils with high levels of lead be stored and placed back in the trench during laying of the sewer line. Following construction, the consultants resampled the area and found that 3 of the 5 surface composite samples, all at the northern end of the sewer, were between 510 ppm lead and 990 ppm lead, with the southern samples at 230 ppm lead. Since the

city's established action level for this project was 500 ppm lead, the consultant suggested mixing the surface soils along the trench with nearby soils. Resampling of this area indicated that all the samples were now less than 330 ppm. The land disturbed by the digging for the sewer line is more than adequately cleaned for the surrounding land use and is now suitable for unrestricted use. The land adjacent to the sewer corridor was agricultural at the time of the Record of Decision and remains agricultural at the moment. It may have remaining pockets of contamination which would require cleanup if the land use were to change in the future.

I. New Sampling conducted as part of the Five Year Review

Based on site plans for each development and observations during construction, the committee chose sampling locations to assure that the construction had been conducted in accordance with instructions provided by the City. The sampling was carried out using the generic sampling plan used at the site during earlier site characterization activities in the 1993 - 1996 timeframe. All the property owners at these new sampling locations granted access for the purpose of this study. (See Results of Chemical Analyses, Appendix G.)

FIVE YEAR REVIEW SAMPLING RESULTS (XRF DATA)

Development	Location	Land Use	Lead (ppm)	Arsenic (ppm)
Marketplace at Naylor Farm	none	vacant	not sampled, development hadn't started	
Salt Lake Comm. College	none	institutional	not sampled, no digging, fill used to contour new ballpark	
Jordan Valley Hospital Expansions	none	institutional	not sampled, in area of a total removal, no wastes left	
The Woods at Creekview	8827 S Pagoda Tree Ln, edge of lawn next to creek channel	residential	558	ND
The Woods at Creekview	3348 W Olive Tree Circle, along south bank of creek	residential	389	36

Development	Location	Land Use	Lead (ppm)	Arsenic (ppm)
The Woods at Creekview	3358 W Olive Tree Circle, along south bank of creek	residential	533	ND
City water line at Cascade Springs	top of creek bank in line with water line at east end of property	high density residential	624	ND
Cascade Springs Apartments	transects across creek channel in front of complex			
	center line of channel at western box culvert outlet	high density residential	496	36
	mid bank at western box culvert outlet	high density residential	292	ND
	top bank at western box culvert outlet	high density residential	268	39
	center line of channel at west end of bridge	high density residential	309	ND
	mid bank at west end of bridge	high density residential	281	34
	top bank at west end of bridge	high density residential	198	33
	center line of channel at east end of bridge	high density residential	218	ND
	mid bank at east end of bridge	high density residential	490	ND

Development	Location	Land Use	Lead (ppm)	Arsenic (ppm)
	top bank at east end of bridge	high density residential	125	ND
	center line of channel half way between bridge and end	high density residential	271	ND
	mid bank half way between bridge and end	high density residential	183	ND
	top bank half way between bridge and end	high density residential	493	ND
	center line of channel at east end of property	high density residential	913	ND
	mid bank at east end of property	high density residential	468	53
	top bank at east end of property (see sewer to property)	high density residential	624	ND
Cascade Springs Apartments	fill brought in to create berms around each building			
	berm at Apt. 2872 W (front of south side)	High density residential	579	ND
	berm at Apt. 2758 W (front of south side)	High density residential	254	ND
Mountain View Business Park	none	commercial/ light industrial	not sampled, pad construction, paved parking lots, utilities under roads	

Development	Location	Land Use	Lead (ppm)	Arsenic (ppm)
Mountain View Townhomes	none	High density residential	not sampled, sampling required by city for occupancy permit	
Bingham Creek Storm Drain Project	Vicinity of box culvert at 2700 W crossing of creek			
	near box culvert outlet head wall and side wall	roadway	2970	144
	near box culvert inlet behind sidewalk	roadway	175	22
	Center line 15 ft from edge of asphalt (half way between culvert and road)	roadway	337	36
	5 feet S of SE corner of headwall, fill material between street and fence	roadway	372	35
	15 feet NW from end of north wing wall along top of creek bank	open space	748	47
	25 feet downstream from end of north wing wall along the top of the north bank	open space	159	ND

Development	Location	Land Use	Lead (ppm)	Arsenic (ppm)
	25 feet downstream from end of north wing wall along the toe of the riprap	open space	33	42
	25 feet downstream from end of north wing wall mid bank on south bank	open space	414	ND
	center line of culvert at NE corner of Vista Montana Apts	high density residential	29	ND
	center line of culvert at NW corner of Vista Montana Apts.	high density residential	357	ND
	center line of culvert at SLC Youth Justice	institutional	35	ND
Duplex on Sugar Factory Road	2429 Sugar Factory, 15 feet from back fence along creek	residential	38	ND
	2449 Sugar Factory, 15 feet from back fence along creek	residential	42	ND
Salt Lake County Youth Justice Center	center line of storm line behind facility (see Bingham Creek storm line)	institutional	35	ND

Development	Location	Land Use	Lead (ppm)	Arsenic (ppm)
	20 feet north of storm line (where utilities enter building)	institutional	278	ND
Sugar Creek Condos	NE Corner along fence at bank of channel	high density residential	555	ND
	NW corner along fence at bank of channel	high density residential	471	31
West Jordan sanitary sewer 1240 W	none	agricultural	no samples collected, sampling required by city following construction, remediation and re-sampling required by city prior to sign off	
SL County Flood Control project, new channel	none	agricultural	no samples collected, not in original Bingham Creek flood plain	
Constructed wetlands along Jordan River	none in the wetlands area	recreational, open space	no samples collected, samples previously collected of footprint of facility and excavated soils.	

The data suggest that the only place where the mining wastes might have been exposed during construction activities is at the new box culvert at the 2700 W street crossing. When the first elevated value was obtained from a sample near the head wall and wing wall, additional sampling suggested that the original elevated level was not representative of the area generally. Even considering the one elevated concentration, the area along the road averaged 963 ppm lead. The additional sampling also suggested that no contamination had been released downstream.

J. Community Interviews

The community interviews, conducted by EPA and UDEQ community involvement coordinators, revealed some strengths and weaknesses of the clean up and post cleanup activities. (See Appendix A for the text of each interview.)

Both old-timers and new residents indicated that the community was well-informed about the project. The new residents learned about the project first from their real estate agents, but more from their neighbors. Several mentioned that the yards were improved over what was originally there and the irrigation systems were also improved. City officials indicated that the cleanups were watched closely by the community; there had been few complaints, and virtually no recent complaints. Several observers thought the city was protecting the remedy, but there hadn't been too much development lately. One observed that when the city installed sidewalks in the neighborhood, they carried away all the excavated soils and brought in new soils for the edges.

Some of the new residents indicated they were informed first about the cleanups by their real estate agents but it was done immediately before or after the closing. Both old-timers and new residents suggested that the soil imported during the cleanup was too sandy and needed soil amendments. Some of the complaints were heard during the removal. One of the old-timers didn't believe the cleanup was needed in the first place. Another indicated that although there was a choice of whether or not to participate, he felt he had to cooperate. It was clear the residents were comparing notes leading one to observe that his neighbors had gotten a better deal than he.

In terms of post-cleanup observations, several residents noticed that the utility workers did not seem to know about the cleanup and were digging without knowledge. Specifically mentioned were the telephone company and the cable company. City workers also noted that residents do not contact the city when they construct "do-it-yourself" projects.

K. Recommendations and Conclusions

The team recommended that the erosional gully found where drainage from the access landfill road and Rt. 111 discharges into the creek channel be repaired before the erosion cuts completely through the cap and exposes the tailings underneath. As a result of this recommendation, the Trans Jordan Landfill management was contacted by EPA. The landfill general manager agreed to repair the problem with the help of the City of South Jordan (which now maintains Rt. 111), and Kennecott, the landowner.

Figure 10: New inlet for road runoff to Bingham Creek

Figure 11: Outfall of new pipe directing road runoff to creek

Figure 12: The erosion gully is filled in and regraded.

The erosional gully was filled in and the runoff from the roads was directed to a new pipe laid underground ending at the channel along the eastern side of Rt. 111. At the outlet of the pipe, rip rap was added to the creek channel to dissipate the energy at the intersection with the creek. The slope from the inlet of the new pipe to the outfall was sufficient to allow the pipe to be laid in a trench through the capping material only. The cap was thick enough near the roads that the wastes were not encountered during the trenching. The construction was accomplished using rubber tired equipment (as opposed to tracks) to minimize damage to the vegetation along the creek. The project was conducted using labor and construction equipment provided by the Trans Jordan Landfill and pipe provided by the City of South Jordan, with revegetation to be provided by Kennecott this fall. (See attached photos.) Project managers were Dwayne Wooley, General Manager of the Trans Jordan Landfill, and Steve Nobel, City Engineer of South Jordan City. Kennecott was consulted throughout the construction - they are the property owner of the creek channel in that area.

The team recommended that additional samples be collected in the area of the 2700 W street crossing box culvert to determine if the contamination found near the head wall was an isolated situation or if contaminated soils had been excavated and spread over a wide area. The additional sampling revealed that the waste exposed near the head wall was an isolated situation.

ARCO's operation and maintenance obligations for the Bingham Creek channel as detailed in the enforcement agreements have now been completed. In addition, the Salt Lake County Flood Control staff are no longer issuing permits for channel maintenance unless the entire design is changed to fit with their later modifications. The team suggests that Salt Lake County Flood Control take over the responsibilities of maintaining the channel as a part of their own operations and maintenance functions. This would require an educational effort to make sure they know where the wastes are located and where future modifications of the channel might encounter the wastes. The City of West Jordan has been effective in providing this type of information to Flood Control during this five year period, but this seemed to be only because the projects along the creek during this period were joint city-county projects. The team recommends that the Salt Lake County Flood Control be briefed on the creek and remedy maintenance issues.

The city public works and information services do have personal and in-depth knowledge of Bingham Creek and the remedy. However, because there has been large turnover in city staff during the past five years, the knowledge is centered with certain individuals and is not generally known by the rest of the city staff. We recommend that background information along with a list of knowledgeable individuals be provided in a training exercise or on an individual basis. It is especially important for city staff to understand where contamination still exists above unrestricted land use levels.

The remedy at OU1 is currently protective of human health and the environment and exposure pathways that could result in unacceptable risks are being controlled.

III. LARGE BINGHAM RESERVOIR - OU4

A. Background

The Large Bingham Reservoir is located just to the south of the town of Copperton at the mouth of Bingham Canyon in the Bingham Creek channel. It was built in 1965 by Kennecott Utah Copper Corp. (hereinafter referred to as Kennecott) to impound Bingham Creek waters and leachate waters from Kennecott mining operations for recovery of metals and industrial process water. The original reservoir was unlined and, located in the recharge area for the principal aquifer, it has been shown to be a major source of groundwater contamination.

The old leaking reservoir was retired and a new one replaced it. The new reservoir is triple lined and is also used for storage of stormwater and process water by Kennecott. The land use is industrial/mining. The nearest residential

community is Copperton, about ½ mile to the northwest. The area is fenced and is not accessible to the general public.

Adjacent to the Large Bingham Reservoir to the north is the Small Bingham Reservoir. The original Small Bingham Reservoir was also constructed in 1965 as a mine waste treatment facility and a sewage lagoon for the town of Copperton. The original reservoir may have been lined with clay.

B. Chronology

DATE	ACTIVITY
1991	Former Reservoir retired from service - began dewatering the reservoir
June, 1992	AOC CERCLA VIII-92-10 - for time critical removal of tailings and sludges from the former reservoir and construction of Basin 1.
1994	New reservoir construction is completed
1994 - present	Performance is monitored by Utah Groundwater Permit UGW 350006
Sept 1998	Reservoir area is included in the No Action ROD
Dec 1998	Final RD/RA CD with Kennecott.

C. Remedy

The original reservoirs were retired from service in 1991. The water was drained, and the sludges, tailings, and underlying soils excavated. Approximately 20 - 30 feet of materials were removed from the reservoir area. The sludges were mixed with alluvium high in calcium carbonate, and placed along the main waste rock dumps behind the leachate collection system. When this portion of the dump slope was relaxed, the soil and sludge mixture was placed on the slope and revegetated. Kennecott then regraded the excavated area and constructed a new reservoir in the same location. The new reservoir has three basins. The first basin is used as a debris collection basin and is lined with concrete to allow access for maintenance. The second and third basins are lined with two layers of HDPE with a leak detection system between the layers. The performance of this reservoir is monitored through a Utah Groundwater Permit.

Figure 13: Zone 1 of the Large Bingham Reservoir showing different water levels

For the Small Bingham Reservoir, in 1990, Kennecott took the reservoir out of service, excavated some of the materials, and installed a new reservoir equipped with clay, geotextile, and HDPE liners with a leak detection system.

D. O + M strategy

The performance of these reservoirs is monitored through a Utah Groundwater Permit (UGW 350006). Each basin of the reservoir has 5 subbasins each having a sump. There is a transducer in each sump which measures the pressure in terms of feet of head. The permit gives the maximum allowable head and required that the feet of head be manually read each week (typically Sunday). In addition, the transducer information is sent to the office in the precipitation plant and there is an alarm if any of the transducers are recording within 0.05 feet of the maximum allowable head. The pressure transducer information is stored digitally and can be recalled to determine long term trends. If the head is rising as detected by the sensors, managers of the facility begin to reduce the water level in the zone affected, so that repairs can be implemented quickly. Although there have been tears in the upper lining, the secondary liner underneath has never been compromised. There are several wells downgradient of the reservoir system which are also monitored as required in the state's Ground Water Permit.

E. Site Inspection Observations

The site inspection team visited the reservoir and interviewed Kennecott personnel involved in operating and maintaining the facility. Marc Oleson is responsible for repairs once the sensors detect a problem. He is notified by Steve Schnoor (in charge of operating the facility). He first conducts a visual inspection. The sensors can tell which subbasin and which zone is affected. Typically, the tears are at the extrusion welded seams during the winter. There are two welds where the liner sheets overlap, one at the top and one at the bottom. The failures are always the top weld. Ice buildup is a problem. He repairs the welds with a patch. He indicated to the team that there is usually some damage each spring, some years worse than others. Last year was a particularly bad year. A small tear along one of the welded seams was initially detected, but after the water level was dropped, the wind got under the tear and ripped the liner further. In the end, 220 feet of liner welds had been torn, three quarters of which was from one rip. There has never been a tear or failure of the bottom liner.

When asked if the tears were due to design or material failures, Mr. Oleson indicated that it was his belief that the installation may have had some impact. For Zone 1, the black lower liner was installed in the cold weather. During warmer weather, the liner would get looser rather than tighter. However, the white upper liner was installed in a hot summer. In that case, the liner would contract in the colder months leading to tears in the upper liner. Regarding aging impacts on the materials, Mr. Oleson indicated that this didn't seem to be an issue. For Zone 1, there had been 4 patches over the last 2 years, but nothing at all required for the Zone 2 liner. The Zone 2 upper liner had been installed during cold weather.

Steve Schnoor is the manager in charge of operating the facility. He described the methods used to monitor the reservoirs for leak detection (described in the O+M section). He indicated that the maximum allowable heads in the permit were 4 feet for Zone 1 and 4.6 feet in Zone 2. The alarms are set at 0.05 feet below this, or 3.95 feet for Zone 1 and 4.55 feet for Zone 2. Each of the 10 subbasins have transducer sensors which can be monitored instantaneously at his office in the Precipitation Plant. His first action when the head values start to rise is to turn on the pumps for the sumps and then watch to see what happens to the head. If there is a leak, the pumps will not solve the problem. If he suspects a leak, he notifies Marc Oleson and begins to lower the water level in the affected Zone. He can pump waters between all the different zones, to the Small Bingham Reservoir, or to the tailings pipeline. The reservoir now contains meteoric leach water.

Mr. Schnoor and Mr. Oleson gave the team examples of the forms they use for the weekly inspections required in the permit. They also have reports describing any repairs made to the liners. (See Appendix H.)

Mr. Schnoor indicated that the debris basin was cleaned out on an "as needed" basis, the last time 3 years ago. The Zone 1 and Zone 2 basins had never been cleaned out, at least yet. Right now the estimated thickness in the bottom of the Zone 1 is 6 - 10 feet, and for Zone 2 is 1 - 2 feet. Sludges will have to be removed when they reach a depth of 20 feet, not because they do any harm, but they would be seriously reducing the water storage volumes available.

Mr. Schnoor demonstrated the instruments located between Zone 1 and Zone 2. The entire basin is enclosed with a high fence and highway barriers. The highway barriers were not sufficiently high enough to prevent deer from getting into the reservoir. Because the surface is slick, the unfortunate animal slid all the way to the bottom. Catching the deer was a challenge. The reservoirs also continue to fire air cannon to keep the birds away from the area. No birds (or deer) were observed at the reservoirs at the time of the team visit.

F. Changes in ARARs or Risk Assessment Science

There are no changes in ARARs or Risk Assessment Science which would affect the design or operation of the reservoirs.

G. Records Inspections

The team inspected the data associated with two groundwater monitoring wells located downgradient of the reservoirs. At well K84, the monitoring records date back to 1976. At that time, the sulfate concentration was 43,264 mg/L indicative of acid leachate. The former unlined Large Bingham Reservoir was known to leak at the rate of approximately 1 million gallons per day of acid leachate, particularly from the sides of the facility. The action taken to retire the old reservoir and replace it with a new one was to stop this major source of ground water contamination. The time series for this well indicates that the sulfate concentrations began to drop with the June, 1990 samples, when the water level was initially dropped in the reservoir. It continued to drop until June 1995 and has remained fairly constant at around 9000 - 10,000 mg/L sulfate since then. The impact of source control measures was also evident in water levels dropping from 20 feet below ground surface in Jan 1984 to about 52 feet below ground surface in December, 1998. Another newer well, B1G951, was installed a little farther downgradient from the reservoir. The sulfate concentrations in this well dropped from 56,600 mg/L sulfate in December, 1992, to 16,200 mg/L in April, 2003. Water levels dropped from 54.91 feet below ground surface to 62.92 feet

below ground surface. This well, too, demonstrates the effectiveness of the Large Bingham Reservoir reconstruction as a ground water source control measure.

The contents of the Utah Ground Water Permit (UGW - 350006) were reviewed. The permit establishes reporting requirements, design criteria of the reservoirs, monitoring requirements (including components and locations), the allowable leakage rate, the maximum allowable head, and methods to be used for repair of the linings of the reservoirs.

H. Recommendations and Conclusions

The operations and maintenance of the Large and Small Bingham Reservoirs is being handled successfully by Kennecott under the supervision of the Utah Division of Water Quality using the provisions of a Utah Ground Water Permit. This CERCLA Five Year Review has no additional recommendations.

The remedy at OU4 is protective of human health and the environment. Because this is an operation facility under the adequate supervision of UDEQ, this OU will not be considered in future Five Year Reviews under CERCLA.

IV. COPPERTON TAILINGS (ANACONDA TAILINGS, ARCO TAILINGS) - OU 5

A. Background

The Anaconda Tailings, also known as Anaconda (ARCO) Tailings, Copperton Tailings, ARCO Copperton Tailings and Utah-Apex Tailings, consists of approximately 3.5 million tons of lead, arsenic, zinc, and silver-bearing, fine-grained sediments covering 41 acres along the south side of Bingham Creek in the north one-half of Section 16, Township 3 South, Range 2 West. It is located adjacent to Bingham Creek. Erosion, seepage and tailwaters from the tailings created contamination along Bingham Creek, Bastian Ditch, and into Bastian Sink, and near-by agricultural lands. The land use is industrial/mining and since remediation occurred, is used for open space. The nearest residential neighborhood is Copperton, about 3/4 mile away. The site is fenced and is not accessible to the general public.

The Bastian Ditch had its origins in the 1880's when water was diverted from Bingham Creek near the Oquirrh foothills to the Bastian Sink vicinity. The ditch carried water as far south as Copper Creek. The Ditch originates in the vicinity of the Anaconda Tailings and roughly follows Utah Highway 111 southward. When Utah Apex constructed their tailings impoundment in 1914, the farmers also used the tailwaters for irrigation. Historical records indicate that the

tailwaters were not free of contamination. Remnants of the ditch could be seen along the south side of the Anaconda Tailings and on Kennecott lands south of the Anaconda Tailings. A recent study of aerial photographs indicates the ditch system continued southward nearly to Butterfield Creek. Subsequent sampling showed scattered elevated lead values in the southern extension of the ditch system. The current land use is industrial and agricultural. The nearest residential neighborhood is Copperton, 3/4 mile away (at northern end of the ditch). The ditch, where it still exists, is not in use.

B. Chronology

DATE	ACTIVITIES
Jan. 1993	UAO issued to ARCO, for EE/CA and removal (CERCLA VIII 93-06)
1997	completion of remedy
Sept 1998	No action ROD
Dec 1998	RD/RA Consent Decree with ARCO
1998 - 2003	Annual O+M reports submitted to EPA

C. Remedy

The Anaconda Tailings Removal Action, which occurred from 1993 to 1997, consolidated the lead tailings from a 96-acre parcel to the western end of the site where they were capped with a HDPE liner, clay, and soils. Also included in the capped area were the soils excavated from ARCO projects along Bingham Creek during Phases II and III. Run-off and run-on controls were installed to prevent water from entering the site, and to prevent erosion of the cap into Bingham Creek during storm events. Drainage from the cap is collected in a channel which discharges to a retention basin. Only overflows from the retention basin would reach the creek channel. The facility was designed to withstand a 100-year storm event.

The tailings deposited in the Bastian Ditch were removed by Kennecott and ARCO on their respective lands. ARCO placed these tailings in the main ARCO tailings capped repository. Kennecott hauled the tailings from their sections of the ditch to the Bluewater Repository.

D. O + M strategy

ARCO has agreed to perform long-term maintenance of the capped repository. There are upgradient and downgradient ground water monitoring wells to insure the cap is effective in prevention of leaching. In addition, Salt Lake County has agreed to use its authorities in land use planning, zoning, and building permits to insure that the cap integrity is not compromised.

E. Site Inspection Observations

The Five Year Review Team and participants visited the Copperton Tailings site to determine if changes were visible in the facility since it was constructed. Present were prime contractor for ARCO and the original EPA On-scene Coordinator for the work. The slopes on the repository cap showed no evidence of erosion or settlement and the vegetation was doing well. The drainage controls, both run-on and run-off controls, were still in good shape and had collected only a very small amount in sediments. The smaller rip-rap initially used in the drainage ditch from the repository to the retention basin had been replaced with larger rip-rap when the smaller size was washed away during a storm. This event had occurred during construction of the facility. The new larger size rip-rap was still in place and was preventing erosion in the ditch. The retention basin dikes were in good shape also and seemed unaffected by any stormwaters. The facility's O + M manager confirmed that water had not risen high enough in the retention basin to overflow into the creek. The maximum depth of water in the retention basin was 3 feet. The overflow chute looked new. The plastic liner in the chute showed hoof prints of deer which had apparently walked on the liner, lost their footing and skidded down to the bottom of the chute. The vegetation on the retention basin dike and in the retention basin itself was doing well. The inspection team were pleased that the trees which had been saved during the cleanup were thriving. Two of the trees near the retention basin had owl nests in them. Deer were observed along the periphery of the site.

Figure 15: Drainage ditch with larger rip-rap lining

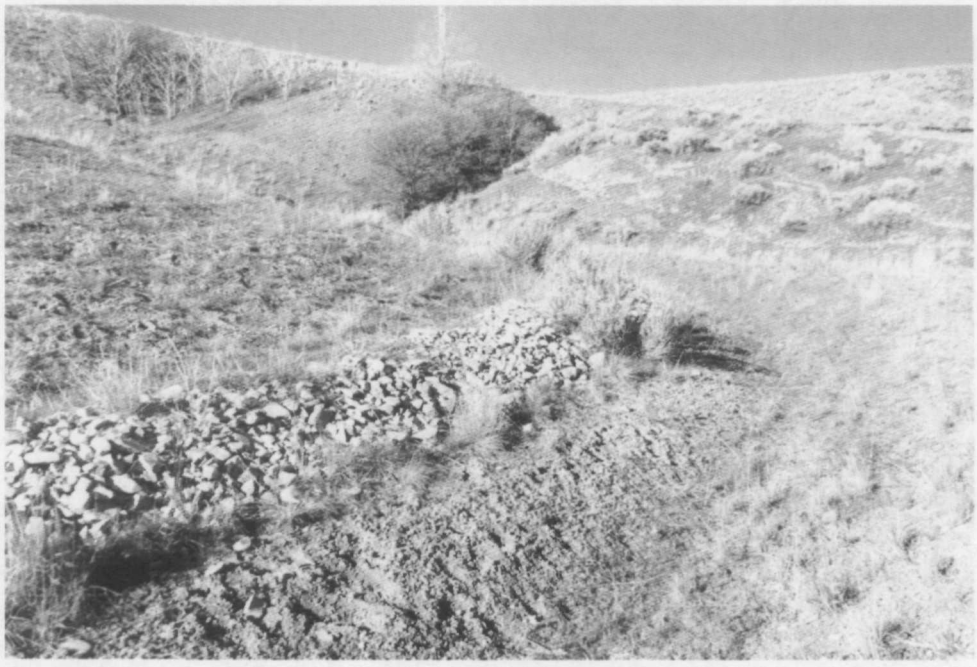

Figure 14: Upgradient side of the Copperton Tails cap

Figure 16: Stormwater retention basin dikes and revegetation of area

F. Changes in ARARs or Risk Assessment Science

Since the remedy for the Copperton Tailings site was designed and implemented, EPA risk assessors have calculated new remediation goals for industrial, recreational and open space land uses. The results of these calculations have already been discussed as a part of the Bingham Creek discussion. The original action level at Copperton Tailings was 2000 ppm lead based on an industrial, recreational and open space land use. The new calculations indicated that a level of 2207 ppm lead was protective. Therefore, the original action level remains protective of human health and actually has a margin of safety when compared to the later calculations. The land use at the facility is unlikely to change. There were no changes in ARARs which would have impacted the design, implementation or O+M of this facility.

G. Records Inspection

The Final Annual Operations and Maintenance Report for this facility was inspected because it contained the records for the past five years in groundwater levels and water quality, settlement, erosion, wildlife usage, and depths of surface flow during runoff events. (See Appendix I)

The ground water levels throughout the area have been dropping. The reason for the water level drops as mentioned in the report is the extended drought period. Also during this period, Kennecott has been trapping alluvial flow down Bingham Creek, stopped the leakage of their reservoir immediately upstream of this site and has several pumping wells in the area. At some wells, the water levels have dropped up to 25 feet.

The water quality around the ARCO Tailings area is generally poor and is characterized by high TDS and sulfates with depressed pH. This is typical of the poor water quality found throughout this area as documented in the RI/FS for the Kennecott South Zone. The poor water quality originates from facilities upstream and is not necessarily related to this facility. Occasionally, pulses of very high chloride surge through the system, appearing first upgradient and later in downgradient wells. This observation has also been noticed in other wells in the surrounding area. Kennecott has attributed this to inputs of water from the volcanic bedrock layer and seepage of hot waters from volcanic sources. The contaminants of interest at this site are lead and arsenic. The upgradient wells had little lead or arsenic. The concentrations in the wells further downgradient were generally low but occasionally had some moderate concentrations. These were only occasional occurrences. Sometimes the higher lead concentration pulses correlated with the higher arsenic pulses, but usually there was little correlation between the two.

The monitoring of the ground water indicated that the deep wells had good water quality but the water from the shallower aquifer was very poor. The monitoring also suggested the presence of multiple water zones. These five water-bearing zones are separated by aquitard layers towards the western edge of the site and then merge as the water moves eastward. ARCO suggests that there is very little communication between the zones until they merge. ARCO also notes that the variations in the concentrations of contaminants in the ground water is not coordinated with meteorical or surface runoff events or seasonal wet-dry cycles. They concluded that the water quality was not influenced by the site. The team notes that the already poor water quality may have precluded any observations of small impacts.

Five settlement markers were installed on the cap of the five cells to determine if settlement was occurring. Between 1999 and 2002, the differences in elevation at these markers ranged from 0.03 - 0.19 feet. Settlement was "slight". No surface erosion of the cap was noted during the annual inspection. Underneath the soil cap is a layer of gravel which is on top of the impermeable liner (HDPE and clay). The water penetrating the soil is discharged in the gravel layer to the toe ditch around the cap. The maximum depth of flow in the north side ditch was 4 - 6 inches; in the south ditch maximum water depth was 8-10 inches. The toe

ditches are about 2 feet deep. The toe ditches merge at the northwest corner of the impoundment and then go to the retention basin. The maximum depth of water in the retention basin was 3 feet. The total depth of the retention basin is 11 feet over an area of about 76,600 sq. ft. The capacity is about 8.4 acre feet and was designed to contain a 100 year storm. No flows have ever been discharged from the retention basin to the creek.

ARCO's staff did find that a family of moles had dug into the soil layer on the southeast corner of the cap, but their diggings contained no rock or gravel. This indicated that the burrows were just below the surface. There was no evidence of deep burrowing animals such as badgers or prairie dogs. (During one site visit in 1998, a badger was observed by EPA and ARCO. Local sources indicate that it was road kill that summer on the highway adjacent to the site on the eastern side.) A herd of deer routinely graze on the cap, both summer and winter. They apparently prefer the vegetation from seed mixtures used on the cap over the plants on the surrounding hillside. There are two owl nests in trees in the retention basin area.

H. Recommendations and Conclusions

The team concluded that the cap and associated run-off and run-on controls were working as designed. The land use is open space and there is evidence that wildlife use the area. The remedy remains protective of human health and the environment.

Although continued monitoring of ground water for the sake of determination of cap integrity is no longer needed, continuation of the monitoring might be useful for those monitoring the movements of the acid plume underneath the site (OU2).

ARCO should continue to maintain security at the site to prevent unauthorized use by ATVs.

Beyond inspections required every five years, the team does not have further recommendations.

The remedy at OU5 is protective of human health and the environment and exposure pathways that could result in unacceptable risks are being controlled.

V. COPPERTON SOILS - OU 10

A. Background

The town of Copperton is located at the mouth of Bingham Canyon adjacent to Bingham Creek on the south side of town. The eastern end of the town was built on an historic tailings deposit, particularly the residences along Copperton Circle. The land use is residential. The tailings deposits extend to industrial lands just to the east of Copperton Circle.

B. Chronology

DATE	ACTIVITY
1994	Removal assessment study, no action needed
1998	No Action ROD

C. Remedy

Historical photographs reveal that the eastern end of the town of Copperton was built on a tailings deposit. The tailings may have come from the experimental Utah Copper mill built in 1903, but this is not known for certain. EPA investigated the area in 1994, and determined that this section of town had, in fact, been built on mine wastes, but the concentrations of hazardous substances were low and well beneath action levels for residential property. EPA determined that no action was required.

D. O + M strategy

No action regarding O+M were required. No hazardous materials above action levels existed on this site.

Figure 17: Remnants of mining wastes still visible in industrial area. (The barrel has been removed.)

E. Five Year Review observations and conclusions

The Team visited the area as part of the Five Year Review. There has been some recent residential construction on vacant lots along 5th E Street in Copperton. The end of Copperton Circle still has exposed tailings but it is fenced off. The land just to the east of Copperton Circle at the time of EPA's study was being used as a laydown yard for railroad related equipment. At the time of the Five Year Review, the laydown yard was cleared away and the ground revegetated. There are still some industrial buildings and associated parking lot on the southwest portion of the land. The former laydown yard area is in use as open space. There appear to be some wetlands on the site. Some of the tailings are still exposed on the former laydown yard footprint.

There are no recommendations. The no-action remedy at OU 10 is protective of human health and the environment and exposure pathways that could result in unacceptable risks are being controlled. Additional Five-Year Reviews are necessary to determine if the land use changes and the conditions are still protective for that land use.

VI. BINGHAM CANYON - OU 11

A. Background

Bingham Canyon is located on the east flank of the Oquirrh Mountains. Mining of mineral resources in Bingham Canyon and it tributaries began in 1863. Open pit mining of copper ores began in 1903 on the headwaters of the canyon. Today, Bingham Canyon Mine open pit is about 2 ½ miles across and over ½ mile deep and is surrounded on the east, south, and north sides by waste rock dumps. Older mining and milling facilities which have been documented in historic literature have been buried by the waste rock dumps or mined away by nearly 100 years of open pit operations.

The area where most of the historic mining operations existed is still occupied by an active mining operation and is zoned industrial/mining. Activities include mineral exploration, blasting in the pit, hauling of ores and waste rock by trucks and rail, and maintenance of the facilities. A visitor center is located near the top edge of the pit, but the access is through the Lark Gate. Kennecott owns all the water rights in the watershed (including stormwater runoff, snow melt and leach waters) and uses them for industrial processing. The mine is fenced and is not accessible by the general public. The nearest residences to the Bingham Canyon Mine are located in the town of Copperton adjacent to the Bingham Canyon Gate. Current operational facilities, including, but not limited to, the Bingham Canyon Mine, the Bingham Canyon Mine Waste Rock Dumps, the Kennecott Precipitation Plant, and the Copperton Yards are not included in this decision document. The footprint of the former Proler operation is not included. Groundwater issues associated with the mine are also not included in this decision document.

B. Chronology

DATE	ACTIVITY
1993	EPA begins compiling a list of historic facilities on various parts of the Kennecott North and Kennecott South Sites
1995	EPA, Utah, and Kennecott sign the Memorandum of Understanding which requires that Kennecott characterize each historic site on its property and clean it up as necessary.
1998	Final report regarding historic sites submitted. No further action was required. (Several historic sites were cleaned up as a part of the Bingham Creek channel action.)

C. Remedy

In 1993, EPA began compiling a list of the facilities known to have operated in the canyon. In 1995, Kennecott began to characterize the sites by describing the locations, what was known about the operations there, and where their wastes were located. If the site was accessible (not buried by waste rock or subsumed by the pit), Kennecott collected samples to determine what hazardous substances were left by these operations. This activity was performed under the provisions of the Kennecott/EPA/UDEQ Memorandum of Understanding signed in September, 1995. The results of the characterization of historic facilities are in three reports called On-Site Environmental Assessments. EPA and UDEQ used the results of that study to determine if cleanups were needed.

EPA and UDEQ concluded that each facility in Bingham Canyon fell into one of several broad categories: (1) facilities whose footprints no longer exist because they have been mined away by the growing Bingham Pit; (2) facilities whose footprints have been buried by waste rock from the Bingham Mine or have been buried underneath a current operating facility; (3) facilities which could be characterized but any contamination found was consistent with the current land use and did not require cleanup; (4) facilities which were characterized and required cleanup; (5) facilities which were found not to have operated and therefore produced no wastes; (6) facilities which were located in areas which were cleaned up during CERCLA and non-CERCLA cleanups; and (7) current facilities.

D. O + M strategy

Bingham Canyon and upper Bingham Creek lands are zoned industrial. Salt Lake County is responsible for insuring that changes in land use are appropriate for the potential physical and chemical hazards on these lands.

E. Five Year Review observations and conclusions

At the beginning of the project, Bingham Canyon was mainly used as a transportation corridor with rails and roads connecting Copperton with the Bingham Pit Mine. Along this transportation corridor were some historic and current facilities including the North Ore Shoot, ruins of the Yampa Smelter, and the 6040 tunnel (used as a rail tunnel to the interior of the pit). Recently, Kennecott began filling the canyon with waste rock. In the process, the above facilities were buried by the encroaching waste rock dumps. At the time of the site inspection, Kennecott was preparing to bury more of the canyon. Rails and utilities were being removed and equipment and spare parts were being moved to

a temporary storage building close to the ground water RO (reverse osmosis) plant. Based on the location of the proposed new toe of the dumps, additional footprints of historic and facilities will soon be buried also. These facilities include the Dry Fork Tunnel, the Dry Fork Truck and Rail Maintenance Shops, the historic Utah Copper Mill foundations and cribbing, and the West Mountain Placer Shaft entrance. Kennecott provided a map showing the proposed toe of the dumps locations. (See attached map.)

The historic Utah Copper Mill foundations and recently removed rail corridor up Bingham Canyon. The toe of the Bingham Mine dumps in the canyon are in the background. Since this photo was taken, the entire area has been buried by waste rock. The mill location and the former rail corridor are no longer accessible.

There are no recommendations. The no-action remedy at OU 11 remains protective of human health and the environment and exposure pathways that could result in unacceptable risks are being controlled. At least one further five-year review is recommended to ensure that wastes associated with historic facilities in the canyon have been buried and are no longer accessible to the public or mine workers.

VII. BASTIAN SINK - OU17

A. Background

The Bastian Sink is located in the south central portion of Section 15 and the north central portion of Section 22, Township 3 South, Range 2 West. It measures 3,000 feet by 1,200 feet at its maximum extremities, totaling approximately 60 acres. It is a topographic low just to the south and east of the Trans Jordan Landfill on State Highway 111. Bastian Sink received waters diverted from Bingham Creek and the Anaconda Tailings Pond via the Bastian Ditch. The water was used to irrigate farmland in the area. The water flowing in the Ditch contained considerable tailings sediments probably derived from flow through the tailings pond.

The current land use is agricultural, but has been zoned for industrial land use. The nearest residence is in Copperton, approximately 2.5 miles to the west. The area is fenced and is not accessible to the general public.

The Bastian Sink contains elevated levels of lead and arsenic due to receiving irrigation waters from Bingham Creek and tail waters from the Anaconda Tailings. Water was conveyed to the area by the Bastian Ditch. There are estimates of 250,000 cubic yards of lead and arsenic contaminated sediments in the Bastian Sink area. This area was characterized by ARCO under the provisions of the Unilateral Administrative Order for Anaconda Tailings. Approximately 22% of the area was found to have elevated lead and arsenic above residential action levels.

B. Chronology

DATE	ACTIVITY
1993	UAO issued to ARCO which included characterization of the Bastian Sink, no action needed, land was in agricultural use. Future use uncertain.
1996	EPA conducts a study on the uptake of lead and arsenic into wheat grains using the Bastian Sink crop.
1998	No action ROD, land still in agricultural use
2002	Consent Decree on OUS 3, 6, 7 allow change in Bastian Sink land use by submittal of a revised O+M plan which includes details of cleanup.

2003	Land to be used by Kennecott for use as buffer to Daybreak multi-use development and possible residential use
2003	Amended O+M plan submitted, including excavation of contaminated soils, backfilling and smoothing out topography with fill generated by Trans Jordan Landfill

C. Remedy

Because the current land use of this area is agricultural, and the zoning is industrial, the lead and arsenic did not pose a significant current risk. In 2003, Kennecott bought the Bastian Sink and proposed to include it in the master plan of their new multi-use development being planned for the adjacent South Jordan Evaporation Ponds area (OU7). Kennecott Land Company is planning to excavate the contaminated soils, and fill in the Sink with fill generated by the neighboring Trans Jordan Landfill when they dig out a new pit. This will be done under the supervision of EPA through changes in the O+M plan as authorized in the Consent Decree for OU 7. The upgraded remedy will produce a site which is suitable for unrestricted land use.

D. O + M Strategy

The City of South Jordan has agreed to provide long term management of the site using its land use planning, zoning, and building permit authorities. The additional cleanups done as a part of O+M will make the site suitable for unrestricted land use. After the hazardous substances are removed from the site, no further institutional controls relative to use of the land will be needed.

E. Five Year Review Observations and Recommendations

At the time of the Five Year Review, no changes had taken place at the site since the original decision. There is a potential land use change being contemplated for the future and the current plans involve the cleanups needed to make the land compatible with the new land use. There are no recommendations at this time.

The no-action remedy at OU 17 is protective of human health and the environment and exposure pathways that could result in unacceptable risks are being controlled. Because of the additional cleanups soon to be performed due to a change in land use, at least one additional Five Year Review will be necessary to ensure that the cleanups detailed in the O+M plan (in association with the change of land use) have been successfully completed.

VIII. SUMMARY

A summary of issues is given in the following table:

SUMMARY OF ISSUES

ISSUES IDENTIFIED IN THIS FIRST FIVE YEAR REVIEW	Affects protectiveness? Y/N	
	Current	Future
OU 1 (Residential) New construction could damage cap	no	yes
OU1 (Channel) Erosion could damage cap	no	yes
OU1 (Channel) Flood control construction could damage cap	no	yes
OU1 (Lower Creek) Changes in land use could change exposures	no	yes
OU1 (Repository) Long term effectiveness unknown - it was effective.	No	no
OU4 Long term effectiveness unknown - it was effective.	No	no
OU5 Erosion could damage cap	no	yes
OU10 Changes in land use could change exposures	no	yes
OU11 Changes in land use could change exposures	no	yes
OU17 Changes in land use could change exposures	no	yes

A summary of recommendations given in the report is given in the following table:

SUMMARY OF RECOMMENDATIONS

Recommendation	Party Respon-sible	Oversight	Milestone Date	Affects Protectiveness? (Y/N)	
				current	future
OU 1 - Bingham Creek					
brief new city employees about Bingham Creek	City of West Jordan	UDEQ	Sept 2004	no	yes

Recommendation	Party Respon-sible	Oversight	Milestone Date	Affects Protectiveness? (Y/N)	
				current	future
repair erosion gully	Trans-Jordan Landfill	EPA	Sept 2003 (done)	yes	yes
brief Flood Control regarding channel maintenance	SL County Flood Control	UDEQ	Sept 2004	no	yes
OU 4, Large Bingham Reservoir					
none					
OU5, ARCO Tailings					
continue open space land use	ARCO	EPA	ongoing	no	yes
continue security	ARCO	EPA	ongoing	no	yes
OU 10, Copperton Soils					
monitor for changes in land use	Kennecott	EPA	ongoing	no	yes
OU 11, Bingham Canyon Historic Facilities					
monitor for changes in land use	Kennecott	EPA	ongoing	no	unlikely
OU 17, Bastian Sink					
O+M activities consistent with changes in land use	Kennecott	EPA	ongoing	no	yes

APPENDIX A

BINGHAM CREEK FIVE YEAR REVIEW COMMUNITY INTERVIEWS

BINGHAM CREEK FIVE-YEAR REVIEW
Salt Lake Valley, UT

In-person community interviews for the Bingham Creek Five-Year Review were conducted in the Salt Lake Valley Monday, July 28, 2003 through Wednesday, July 30, 2003. The interviews were conducted by Dave Allison of the Utah Department of Quality, and Britta Campbell and Nancy Mueller of Region 8 of the Environmental Protection Agency. Residential property owners and municipal officials were interviewed.

Overall, those interviewed expressed minimal health and environmental concern regarding the clean up of the Bingham Creek Channel. Residential property issues related to the quality of the top soil brought in to replace the soil that was removed. Another concern was that individuals who purchased properties in the area after the clean up were not always made aware of the situation until at or very near to mortgage loan closing. There has been a great deal of staff turnover at West Jordan and South Jordan Cities since the time of the cleanup; therefore, there isn't much "institutional" memory remaining in those municipalities.

ContactCraig Dearing, President, CEO
Jeff Maaga, Chair-Elect
West Jordan Chamber of Commerce

Date of Interview: July 28, 2003

BINGHAM CREEK CHANNEL
FIVE-YEAR REVIEW QUESTIONS

1. What do you know about the Bingham Creek clean up?

Mr. Dearing stated that the Chamber of Commerce played an active role in informing residents and businesses along Bingham Creek of EPA and UDEQ activities. The Chamber worked closely with EPA and UDEQ community involvement staffs during the clean up. Overall, Mr. Dearing and Mr. Maaga felt that the aesthetic improvements as a result of the clean up were very helpful. Mr. Dearing and Mr. Maaga both expressed concerns regarding future use restrictions that might be placed on businesses (existing and new) in the area.

2. Were you in the area during the period of the clean up? (1991-1998)

Both Mr. Dearing and Mr. Maaga were in the area during the period of the clean up.

Was your property among those cleaned up?

N/A

3. Do you have any *personal* concerns regarding the clean up? Are you aware of any *community* concerns?

Mr. Dearing does not have any personal concerns regarding human health or the environment as a result of the Binham Creek removal action. Mr. Dearing stated the clean up helped the residents by improving their yards. Mr. Dearing is unaware of any complaints from businesses in the area and hopes EPA does not need to come back and do additional work.

Mr. Dearing would like to know who is keeping track of the development in the cleaned up areas. If there isn't anyone watching, he feels there ought to be. Mr. Dearing said EPA and UDEQ did a good job informing everyone from the start and worked well with the City, residents, businesses and Kennecott.

4. Have you noticed anything going on in the area that you believe might have damaged or compromised the remedy?

Mr. Dearing does not believe the remedy has been compromised. He cited recent construction projects such as a hopsital, industrial park and apartment complex as examples of developers and contractors working with the City. He believes the City of West Jordan is very conscious of the cleaned up area.

5. Do you have any additional comments, suggestions or questions regarding the clean up?

None stated

6. Do you know of anyone else we should interview?

Tom Steele, West Jordan Assistant City Manager
Representative Steve Mascaro

Interviewed By:

Dave Allison, UDEQ
Britta Campbell, EPA
Nancy Mueller, EPA

Contact Melanie Briggs
West Jordan City Recorder
(& resident of West Jordan)

Date of Interview July 28, 2003

BINGHAM CREEK CHANNEL
FIVE-YEAR REVIEW QUESTIONS

1. What do you know about the Bingham Creek clean up?

Ms. Briggs is very familiar with the clean up. She has been a resident of West Jordan since 1980 and has worked for West Jordan City since 1992. Her residential property was included in the sampling and analysis program, but ended up outside the area of concern.

2. Were you in the area during the period of the clean up? (1991-1998)

Yes - Ms. Briggs lived and worked in West Jordan during the stated time period.

Was your property among those cleaned up?

No - her property was sampled, but fell outside the area of concern.

3. Do you have any *personal* concerns regarding the clean up? Are you aware of any *community* concerns?

Ms. Briggs does not have any personal issues with the clean up. She did have her young children tested for elevated blood lead at the time of the clean up. Ms. Briggs said she felt the community had a lot of knowledge of the cleanup. She stated that the City took an active role in informing property owners about the contamination and the clean up process. She also stated that the University of Cincinnati was really good at the way they went about the blood lead testing in the community. She felt that residents at the time of the clean up were quite well informed, but isn't as sure about new residents that have moved into the area since the clean up.

She mentioned that a couple property owners were investigating litigation at the time of the clean up, mainly due to blood lead levels and property value issues. She felt that complaints were minimal, given the scope of the clean up. She stated that the topic of the clean up comes up rarely these days.

4. Have you noticed anything going on in the area that you believe might have damaged or compromised the remedy?

Ms. Briggs mentioned some new housing/apartment construction is scheduled within the year in the vicinity of the clean up area (Raspberry Place?). She doubts the remedy would be compromised, and to be sure, suggested the West Jordan Planning Department would probably know more.

5. Do you have any additional comments, suggestions or questions regarding the clean up?

No

6. Do you know of anyone else we should interview?

Bill Bailey and Tom Burdett of the West Jordan Planning and Engineering Department

Interviewed By:

Dave Allison, UDEQ
Britta Campbell, EPA
Nancy Mueller, EPA

*Contact*Homeowner #1 *Date of Interview:* July 28, 2003

BINGHAM CREEK CHANNEL
FIVE-YEAR REVIEW QUESTIONS

1. What do you know about the Bingham Creek clean up?

Homeowner #1 stated the family moved into the area in 1997. Much to their surprise, the cleanup of the property was disclosed immediately prior to the closing on the property. (The information had been revealed to the seller's realtor, who revealed it to the buyers' realtor.) As a young family with a child on the way the homeowners were concerned and had some reservations. The potential new homeowners were able to locate a document linked to the property title that had information regarding the clean up of the property, but couldn't remember exactly what it said. After speaking to the neighbors and reading through all available (or provided) information, the sale went through.

The homeowner knew that the clean up involved soil contamination (not sure of the contaminants), and that the top 12 - 18" of soil was removed and replaced.

2. Were you in the area during the period of the clean up? (1991-1998)

No - arrived in 1997.

Was your property among those cleaned up?

Yes

3. Do you have any *personal* concerns regarding the clean up? Are you aware of any *community* concerns?

Homeowner #1 stated that having contaminated soil in the yard (below the clean cover) is "scary" since there are now two young children living in the home. The homeowners have installed a patio, sprinkler system and sandbox, and thought a lot about the possibility of going below the cap (we assured her that this possibility was highly unlikely, given the depth of the cap). The homeowner stated that there are no current health concerns or worries as they believe their yard was taken care of. The homeowner mentioned that her older child "may have had blood tests," but she wasn't sure. She plans to have the test done this fall when he has his school physical.

The only community concerns Homeowner #1 is aware of is that her neighbors keep telling her how lucky she was to NOT live in the area during the digging. They tell her it was a "hard time." She has also heard minor complaints about things "not being put back right."

4. Have you noticed anything going on in the area that you believe might have damaged or compromised the remedy?

The "cable guys" are always in the neighborhood, digging ditches to lay cable. She's not sure that they are aware of the underlying contamination or whether they put the excavated dirt "back in the hole."

5. Do you have any additional comments, suggestions or questions regarding the clean up?

The homeowner stated she and her family are happy, and that the neighbors know a lot about the cleanup. It was the "talk of the town." She stated it would have been nice to have known sooner about the clean up so the decision whether or not to purchase the property wouldn't have had to have been made under quite such stressful conditions. She asked whether any retesting had been done since the clean up. We indicated we didn't think so.

6. Do you know of anyone else we should interview?

No one by name

Interviewed By:

Dave Allison, UDEQ
Britta Campbell, EPA
Nancy Mueller, EPA

Contact: Homeowner #2 ***Date of Interview:*** July 29, 2003

BINGHAM CREEK CHANNEL
FIVE-YEAR REVIEW QUESTIONS

1. What do you know about the Bingham Creek clean up?

Homeowner #2 indicated that the original creek bed, prior to channelization and development, of Bingham Creek ran practically through the middle of his living room. This homeonwer held a number of City and County positions, including West Jordan City Manager and County Flood Control Director, prior to retirement. He was very aware of all the work that went on prior to, during and after the clean up started.

2. Were you in the area during the period of the clean up? (1991-1998)

This homeowner has been a resident since 1970; his property was cleaned up in 1992.

Was your property among those cleaned up?

Yes

3. Do you have any *personal* concerns regarding the clean up? Are you aware of any *community* concerns?

Homeowner #2 has no personal issues but does have concerns regarding City management of the cleaned up areas. For example, a Church was built in a cleaned up area. The homeowner was involved in the construction of the Church, and was surprised that the issue of contamination was never brought up during the process (including obtaining all necessary permits). The homeowner felt the questions should have been raised, and care taken during construction to make sure excavated materials were properly handled.

4. Have you noticed anything going on in the area that you believe might have damaged or compromised the remedy?

Homeowner #2 hasn't seen any overt problems. Construction of apartment complexes has occurred in the cleaned up area. Individual home construction hasn't occurred a lot; the area is nearly " built out." He was not concerned at all about the construction of the hospital since 8' - 10' of clean fill was brought in and compacted prior to the onset of excavation. He sometimes is concerned when underground utilities are worked on; wonders if the workers really know what they're working in.

5. Do you have any additional comments, suggestions or questions regarding the clean up?

Overall, Homeowner #2 thought the entire project went very well. He was pleased to get an irrigation system operational in his yard after the clean up, and was only mildly disturbed as the process was going on.

6. Do you know of anyone else we should interview?

Interviewed By:

Dave Allison, UDEQ
Britta Campbell, EPA
Nancy Mueller, EPA

Contact: Homeowner #3 ***Date of Interview:*** July 29, 2003

BINGHAM CREEK CHANNEL
FIVE-YEAR REVIEW QUESTIONS

1. What do you know about the Bingham Creek clean up?

These homeowners moved into their home in 1999. They learned of the clean up after closing on their mortgage ("...oh, by the way..."). They didn't feel like anyone was hiding anything, though. They have spoken to some of their neighbors who indicated they really weren't given much choice in the matter. If they did not allow their properties to be cleaned up, the area might be "blighted" or there could be some problems during future property transactions and title searches.

2. Were you in the area during the period of the clean up? (1991-1998)

No

Was your property among those cleaned up?

Yes - but not disclosed until after real estate closing.

3. Do you have any *personal* concerns regarding the clean up? Are you aware of any *community* concerns?

These homeowners have no health concerns; however, they are very displeased with the quality of the soil that has been placed in their yard. Some areas are OK, but for the most part, it is very poor quality, sandy soil. They do not feel that EPA "did the community justice." Some of their neighbors indicated to them that prior to the clean up the soil was very fertile; now it needs lots of amendments. Even though they moved into their home after the clean up, they are not happy with the decisions that were made.

4. Have you noticed anything going on in the area that you believe might have damaged or compromised the remedy?

No information to add

5. Do you have any additional comments, suggestions or questions regarding the clean up?

No

6. Do you know of anyone else we should interview?

Neighbors - Dan Epson (Ipsen?), possibly the retired Chief of Police; Mr. Wright, Mr. Beasly

Interviewed By:

Dave Allison, UDEQ
Britta Campbell, EPA
Nancy Mueller, EPA

Contact: Homeowner #4 ***Date of Interview:*** July 29, 2003

BINGHAM CREEK CHANNEL
FIVE-YEAR REVIEW QUESTIONS

1. What do you know about the Bingham Creek clean up?

Homeowner #4 has lived in the area since 1947 and was familiar with historic mining operations in the area.

2. Were you in the area during the period of the clean up? (1991-1998)

Yes

Was your property among those cleaned up?

The residential property occupied by Homeowner #4 was sampled but not a part of the clean up. However, other property previously owned was.

3. Do you have any *personal* concerns regarding the clean up? Are you aware of any *community* concerns?

Homeowner #4 has no concerns. He and his family have lived in the area since 1947 and ate a lot of vegetables grown in soils that were part of the area that was cleaned up. Three or four other neighborhood families did the same, and no ill effects were ever observed. The homeowner stated that his children, and other neighborhood children, played along Bingham Creek (channel and banks) prior to the cleanup; again, no ill effects were observed. (Children are adults now.)

4. Have you noticed anything going on in the area that you believe might have damaged or compromised the remedy?

Nothing that the homeowner could recall

5. Do you have any additional comments, suggestions or questions regarding the clean up?

No

6. Do you know of anyone else we should interview?

No names provided

Interviewed By:

Dave Allison, UDEQ
Britta Campbell, EPA
Nancy Mueller, EPA

Contact: Tom Steele
Assistant City Manager
West Jordan, UT

Date of Interview: July 30, 2003

BINGHAM CREEK CHANNEL
FIVE-YEAR REVIEW QUESTIONS

1. What do you know about the Bingham Creek clean up?

Mr. Steele is relatively new to the position of Assistant City Manager (2000) and knows very little about the clean up. He is aware of some of the areas that were cleaned up, and has heard some discussion regarding the residential clean up. He has spoken with the EPA Remedial Project Manager.

2. Were you in the area during the period of the clean up? (1991-1998)

No

Was your property among those cleaned up?

N/A

3. Do you have any *personal* concerns regarding the clean up? Are you aware of any *community* concerns?

Mr. Steele has no personal concerns about the clean up. He is concerned, however, with any impacts to the development of light rail through West Jordan, as well as the trail system that is part of the Bingham Creek Master Plan. He is unaware of any citizen/community concerns beyond those he expressed.

4. Have you noticed anything going on in the area that you believe might have damaged or compromised the remedy?

Mr. Steele is unaware of any issues. Any properties undergoing future development would have the benefit of engineering reviews, which should catch any issues before they arise. He is aware of some minor projects in the area of clean up (grubbing weeds, clean up of Teton Park and storm water ponds off 7800 South) but does not believe they would have disturbed any part of the remedy.

5. Do you have any additional comments, suggestions or questions regarding the clean up?

No

6. Do you know of anyone else we should interview?

None named

Interviewed By:

Dave Allison, UDEQ
Britta Campbell, EPA
Nancy Mueller, EPA

Contact: Tom Burdett, Director of Community Development
Bill Bailey, Building Official
Ray Meldrum
City of West Jordan, UT

Date of Interview: July 30, 2003

BINGHAM CREEK CHANNEL
FIVE-YEAR REVIEW QUESTIONS

1. What do you know about the Bingham Creek clean up?

Bill Bailey is the only Planning Engineer with West Jordan City who was present during the entire clean up. He worked "hand-in-hand" with the EPA Remedial Project Manager throughout the project. Tom Burdett and Ray Meldrum are both relatively new to West Jordan City government and did not know much about the project.

2. Were you in the area during the period of the clean up? (1991-1998)

Mr. Bailey worked for the City of West Jordan during the entire project.

Was your property among those cleaned up?

N/A

3. Do you have any *personal* concerns regarding the clean up? Are you aware of any *community* concerns?

Mr. Bailey stated that there hasn't been a lot of new construction since the clean up. He is unaware of any concerns at this time; there haven't been a lot of citizen calls for quite some time and he is unaware of any current community concerns. Mr. Bailey also said that the permitting process ("in a perfect world") would catch any major construction projects. Often, individual homeowners to not apply for any sort of permit while doing do-it-yourself tasks around their home, so those projects may fall through the cracks.

Mr. Meldrum said the City's engineering review would draw attention to areas of concern. Mr. Burdett added that a geo-tech study is a "conditional" check, which would reveal contaminated soils in any areas of new construction. Mr. Burdett recalled a recent construction project without a "noise permit" that was shut down due to the Planning Department review process. Mr. Meldrum asked for contact information and was provided UDEQ and EPA technical contact information.

4. Have you noticed anything going on in the area that you believe might have damaged or compromised the remedy?

Of the 3 city officials, only one knew of someone who might be tracking the exchange of properties. Shortly after the clean up residents would call to check when digging in their yards, but those calls have dropped off. The utilities do not get permission from the City prior to excavating.

5. Do you have any additional comments, suggestions or questions regarding the clean up?

Mr. Burdett indicated the City would really like an "overlay" of the cleaned up properties, or perhaps an electronic GIS database to incorporate environmental concerns with the City's General Plan.

6. Do you know of anyone else we should interview?

No names provided

Interviewed By:

Dave Allison, UDEQ
Britta Campbell, EPA
Nancy Mueller, EPA

Contact: Rick Horst, City Manager
Steve Noble, Deputy City Manager
City of South Jordan, UT

Date of Interview: July 30, 2003

BINGHAM CREEK CHANNEL
FIVE-YEAR REVIEW QUESTIONS

1. What do you know about the Bingham Creek clean up?

Mr. Horst is new to his position as are a lot of City officials. Doesn't have much history; some upper management has knowledge of pollutants in the area. (Aware of clean up Kennecott is doing/has done for their new development - Sunrise/Daybreak.)

Neither had extensive knowledge, but felt the clean up was watched closely by the community and that there had been quite a bit of publicity

2. Were you in the area during the period of the clean up? (1991-1998)

No

Was your property among those cleaned up?

N/A

3. Do you have any *personal* concerns regarding the clean up? Are you aware of any *community* concerns?

Mr. Horst said there isn't any concern from South Jordan City or the community at this time. There was not a lot of work done in the area, but what was done was watched closely. The community put a lot of faith and trust in EPA. What happens with Kennecott and how the mine plays out over the next decade is important and Kennecott has to make sure the community knows what is going on or people will not be buying homes. Mr. Noble said he thought the relationship with Kennecott was at times adversarial, but no longer. Kennecott is doing more to improve their image and any concerns with development over the years have been satisfied at public hearings. Mr. Horst said the big South Jordan concern is the restoration of the County's (?) erosion field gravel pit south of Bingham Highway (may be annexed into City). The Sunrise/Daybreak development is very important to the City growth area. Mr. Horst is confident the community would know if there was a problem. A number of concerns came out during meetings regarding the new subdivision, but have apparently gone away.

4. Have you noticed anything going on in the area that you believe might have damaged or compromised the remedy?

Neither Mr. Horst nor Mr. Noble were aware of any disturbances along the creek channel. Once again, the concern regarding the gravel pit was mentioned.

5. Do you have any additional comments, suggestions or questions regarding the clean up?

The City of South Jordan is grateful that the clean up occurred, and that it was done right.

No names provided

Interviewed By:

Dave Allison, UDEQ
Britta Campbell, EPA
Nancy Mueller, EPA

Contact: Homeowner #5 ***Date of Interview:*** July 30, 2003

BINGHAM CREEK CHANNEL
FIVE-YEAR REVIEW QUESTIONS

1. What do you know about the Bingham Creek clean up?

These homeowners indicated they did not know much about any historic contamination and were unaware of any problems while they lived in the area until the sampling began.

2. Were you in the area during the period of the clean up? (1991-1998)

Yes, property owners since 1969

Was your property among those cleaned up?

Yes, some areas in the back yard were done with some excavation around trees but sampling showed parts of the front yard having elevated levels and it was never cleaned up.

3. Do you have any *personal* concerns regarding the clean up? Are you aware of any *community* concerns?

No health concerns from these homeowners; they feel their children are happy and healthy as can be. They do not have much good to say about the clean up. They feel their yard was not completely cleaned up to the same extent as surrounding properties. Their property was only partially cleaned up because the workers needed to use those parts to access adjacent properties. The homeowner stated that the how EPA got in and out of the other properties wasn't really his concern, but "...they had us by the short hairs and we had to let them do it." This homeowner is very dissatisfied with the quality of the soil (too sandy) and the fact that after successfully eradicating nearly every type weed in their yard they had to start over because weeds came back with the new soil. They are very glad the clean up is over. The one thing this homeowner did like about the clean up was that irrigation was piped in, but if flood irrigation is used, it just washes the sandy soil away and narrow ditches become gullies.

They are very unclear and uncertain WHY part of their front yard was not cleaned up, even though it showed elevated levels of contamination. (The area in question is a raised "garden" with an old wagon, pine trees, cactus and bear grass. There appears to be little or no chance of exposure, and apparently during the design of that particular property's clean up, it was determined that moving the wagon would probably destroy it.)

4. Have you noticed anything going on in the area that you believe might have damaged or compromised the remedy?

The homeowners have observed the telephone company (or other utility) haul dirt around in the neighborhood.

5. Do you have any additional comments, suggestions or questions regarding the clean up?

No

6. Do you know of anyone else we should interview?

No names provided

Interviewed By:

Dave Allison, UDEQ
Britta Campbell, EPA
Nancy Mueller, EPA

Contact: Homeowner #6 ***Date of Interview:*** July 30, 2003

BINGHAM CREEK CHANNEL
FIVE-YEAR REVIEW QUESTIONS

1. What do you know about the Bingham Creek clean up?

This homeowner became aware of the clean up when her yard was tested for lead. He house paint was also tested. She had her children's blood lead evaluated.

2. Were you in the area during the period of the clean up? (1991-1998)

Yes. This particular homeowner lived in a home "down the street" and moved to the current residence within the past couple years.

Was your property among those cleaned up?

Yes; both the former and current properties were cleaned up.

3. Do you have any *personal* concerns regarding the clean up? Are you aware of any *community* concerns?

Since this homeowner has 3 small children, she was concerned that "they didn't get it all." However, she seemed OK with living in the neighborhood.

4. Have you noticed anything going on in the area that you believe might have damaged or compromised the remedy?

New sidewalks were installed after the clean up. Apparently there was a significant amount of excavation of soils during that activity. She indicated the excavated soil was hauled off and new fill brought in to compact around the new walks.

5. Do you have any additional comments, suggestions or questions regarding the clean up?

Not really. We asked if any disclosure of the clean up was made at the real estate closing on the current property. She said she didn't think so, but couldn't remember for sure.

6. Do you know of anyone else we should interview?

No names given

Interviewed By:

Britta Campbell, EPA
Nancy Mueller, EPA

APPENDIX B
ADVERTISEMENTS ABOUT THE FIVE YEAR REVIEW

DESERET MORNING NEWS, MONDAY, JULY 21, 2003

EPA Five-Year Review of the Bingham Creek Site

The Environmental Protection Agency (EPA), in cooperation with the Utah Department of Environmental Quality (UDEQ) is conducting a Five-Year Review of the Bingham Creek Site. The purpose of a five-year review is to determine whether or not the clean up and other action taken at the site remain protective of human health and the environment.

The Bingham Creek Site is located in the southwestern portion of the Salt Lake Valley. It encompasses nearly all of the Bingham Creek drainage out of the Oquirrh's to the Jordan River as well as residential, agricultural and commercial land adjacent to the Creek. The Site was contaminated with lead and arsenic by runoff from historical mining activities.

From 1991 to 1998, EPA and UDEQ provided oversight to Kennecott and ARCO (the parties who assumed responsibility for the contamination) in their efforts to clean up the creek bed and adjoining lands.

The Five-Year Review will include community interviews, a review of site documents and data and a site inspection to evaluate all remedy components. The review is scheduled to be completed by September 2003 (five years after the start of construction of the first remedy component.) EPA will prepare a report summarizing the results.

If you would like more information about the review or would like to participate in an interview, please contact:

Nancy Mueller
EPA Community Involvement Coordinator
1-800-227-8917 ext. 6602
email: Mueller.nancy@epa.gov

Dave Allison
UDEQ Community Relations Manager
801-536-4479
email: dallison@utah.gov

Section B, pg. 3

The Salt Lake Tribune UTAH Monday, July 21, 2003

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Section D, pg 3

APPENDIX C
BINGHAM CREEK OU'S FIVE YEAR REVIEWS SITE INSPECTION REPORT

BINGHAM CREEK OU'S FIVE YEAR REVIEW
SITE INSPECTION REPORT

INTRODUCTION

The objective of the Five Year Review (required by CERCLA) is to determine if the selected remedy remains protective of human health and the environment. A part of the Five Year Review process is to visit the site, examine the remedy, inspect the operations and maintenance aspects of the remedy, and determine if the remedy is working as it was designed. In this case, most of the remediation was accomplished through use of emergency response/removal authorities, and therefore the selected remedy was a further action determination. The remedies themselves were described in a series of Action Memoranda.

MAY 6, 2003, COPPERTON TAILINGS (aka ANACONDA TAILINGS, UTAH-APEX TAILINGS, ARCO TAILINGS)

The Copperton Tailings are located on the west side of Rt. 111 (opposite of the entrance to the Trans Jordan Landfill, and just south of Bingham Creek.

Participating in the site inspection for Copperton Tailings were Steve Way (EPA, original OSC for the site), Eva Hoffman (EPA, lead RPM, current OSC), Pam Kaye (ARCO, site project manager), Ron Segura (U. S. Bureau of Reclamation, lead for oversight of original construction), Steve Anderson (Anderson Engineering, prime contractor for ARCO), Neil Ferrell (Anderson Engineering, monitoring and O+M), and Brian Vinton (North American Mine Services, a contractor for Kennecott which is a prospective purchaser).

The group drove to the western end of the tailings pond repository and inspected the rip-rap protecting the cap on the upstream site. It was intact and showed no degradation from erosion or settlement. The vegetation on the cap was doing well. The monitoring wells surrounding the repository showed only general regional trends and did not indicate any impacts from the repository. Wildlife observed at the site included owls and deer. Although the latest monitoring report submitted by ARCO indicated the presence of some animal burrows, these were not observed in the inspection. (The group only looked at the periphery of the cap and did not walk out onto the cap itself.)

The group proceeded to the eastern end of the repository to examine the drainage system for the facility. The rip-rap associated with the original drainage ditch close to the repository had washed out soon after construction. The smaller rip-rap which has washed away had been replaced by larger rocks. The larger rocks were doing the job of preventing erosion in the ditch and were heavy enough to withstand erosional events. The retention basin dikes showed no evidence of wear. The overflow route of the retention basin had been protected by HDPE held down by rip-rap and the top and bottom. There were some deer hoof prints and marks on the HDPE which suggested that deer had slipped, fallen on the liner and skid down to the bottom. The HDPE was heavy enough to support the weight of deer and men (walking or sliding) without tearing or even making impressions. In this area there were two owl nests in the nearby trees.

The group discovered no problems and made no recommendations for further work needed at the site.

MAY 6, 2003, ZONE 19 (ARCO portion) of UPPER BINGHAM CREEK
KENNECOTT CHANNEL FROM ZONE 19 EAST TO BINGHAM FLATS

Zone 19 of Upper Bingham Creek is that portion of the creek channel just east of Rt. 111 and just north of the Trans Jordan Landfill. This section of the creek channel was remediated by ARCO and is owned by Kennecott. Participating in the site inspection were the group listed for Copperton Tailings and additionally Doug Bacon (UDEQ, State Project Manager), Dave Allison (UDEQ, State Community Affairs Specialist), and Jon Cherry (Kennecott, Project Engineer).

In the Zone 19 portion of the creek, ARCO excavated 3 feet of contaminated sediments and tailings, replaced them with clean fill, and revegetated the channel. The channel and its banks were inspected for erosional damage which, if severe, could expose the hazardous substances underneath. Near Rt. 111, the group found one erosional gully, which apparently was the result of drainage from the landfill access road and also Rt. 111. The revegetation effort was holding up well.

In the Kennecott Channel, the creek vegetation was very thick and no erosion was noted. There was a bare spot on the south side of the channel opposite Bingham Flats. The cause of this was not readily apparent because it was isolated, on relatively flat ground, and was not typical of erosion damage. The Bingham Flats appeared to be productive agricultural ground.

The only recommendation made for these two sections of the creek involved addition of rip-rap to the erosional gully formed by road drainage.

MAY 6, 2003, KENNECOTT CHANNEL PROJECTS DOWNSTREAM OF INTERSTATE BRICK

Kennecott remediated the creek channel between the Interstate Brick Company downstream (east) to about 3200W. There were several properties which were adjacent to the channel that were remediated at the same time. Kennecott did a complete removal of the tailings in the creek channel. Land use is unrestricted in the area and there are no digging prohibitions. The group participating in this visit was the same as mentioned in the Zone 19 inspection.

The group visited the ball park in South Jordan at _____ . The vegetation along the slopes above the ball park was doing very well and the adjacent channel had nice vegetation including grasses and shrubs. There was no evidence of erosion. The next stop was at the playground in West Jordan at about _____. In the days before remediation, the channel just west of the playground was used for a mountain bike trail. There was little vegetation but lots of bike tracks in the dried mud. This portion had been cleaned up and a fence erected at the park. The area is now thickly vegetated with high grasses and shrubs.

The group visited the on-going hospital construction. The hospital now called Jordan

Valley Hospital (formerly Holy Cross) is scraping the ground near the creek for expansion of their parking lot. The channel itself has not been touched (at least yet). Near the hospital, just downstream, there are three new houses being built adjacent to the creek. The landscaping goes right down to within a foot or two of the creek channel. Because there was a total removal, impacts are not expected as a result of these new construction projects.

The group made no recommendations regarding these sections of the creek remediation, except to confirm through sampling that the construction activities near the hospital had not encountered any wastes inadvertently missed in the initial removal.

MAY 6, 2003, ARCO CHANNEL PROJECTS IN THE IRECO NEIGHBORHOOD

Since ARCO cleaned up the Bingham Creek channel and delta area in 1993-4, the vacant land formerly owned by IRECO has been sold and developed into a light industrial park, a high density residential area (apartment complex and condominiums). In addition, the adjacent roads were widened, the creek channel was straightened, and the original box culvert for the creek under 2700 W was replaced with a larger capacity. For this section of the creek, the group was joined by David Murphy and _____ with the Public Works Department of the City of West Jordan. The private construction had been supervised by the building permit and inspection staff of the city, and the public works were done by or under the supervision of Public Works.

The light industrial park has a number of tenants including a bakery. It appears that the buildings in the park are built using slab on grade construction. The bakery was housed in the largest building, and the building was surrounded by asphalt parking lots and loading docks.

The apartment complex was about 8 separate buildings each constructed using slab on grade. Decorative berms were added around the foundation and entrances, presumably using imported fill. The areas which were not paved had sod in good condition. The creek channel is located in front of the complex and is landscaped with trees and riprap. The utilities enter the complex at the southeast corner (there is a manhole).

The condominium development did involve digging into the remedy for the basement and subfoundations. Kennecott confirmed that the developer had arranged for the unearthed soils to be hauled to Kennecott's repository for disposal. The footprint where the soils were initially stored prior to disposal is now paved and is used for parking.

There is a new box culvert for the creek under 2700 W (just downstream of the canal and the apartment complex). It did not appear that the creek was disturbed significantly in this project. The only bare dirt associated with this project was roadbase along the shoulder of the road as it crosses the culvert. The culvert was concrete and had concrete headwalls.

The group had no recommendations for this section of the creek, except to confirm with sampling that the berms constructed around the apartment house buildings did, in fact, come from imported fill, not Bingham Creek.

MAY 6, BINGHAM CREEK RELOCATION PROJECT NEAR ASPHALT PLANT

Just to the south of the asphalt plant (near the conjunction of Bingham Creek with the Jordan River), Bingham Creek has been rechannelized to a new course to the south of the former channel. The "new" Bingham Creek Channel now goes south of the asphalt plant; whereas the "old" channel has an outfall to the north of the asphalt plant. At the junction of the new and old channel is a diversion structure which can be adjusted, but is mainly used to send the historic flows of 10 cfs down the old channel with the remainder being diverted to the new. The new channel is lined with riprap, is straight (no meanders) and is parallel to the Jordan River. The new channel has a growth of aquatic grasses in the bottom.

MAY 6, STORMWATER MITIGATION USING WETLANDS

Near the conjunction of the former Bingham Creek channel and the Jordan River, the City of West Jordan constructed wetlands to treat stormwater runoff from 7800S. The stormwater enters the area from 7800S under the railroad. After a debris removal basin, the water then enters a wetland area consisting of two deeper basins of open water surrounded by shallower areas which have grassy vegetation. The project was aided by state staffers including Doug Bacon, and by EPA project officer, Robin Coursen. The Fish and Wildlife Service was also consulted regarding the design and the action level used. The original action level of about 133 ppm lead for the soils/sediments was later changed because of excessive cost to remove that much sediment. The final action levels were 1000 ppm lead for hot spot removal and 500 ppm lead for area-wide levels. (See Table 1.) Kennecott had agreed to accept these soils for use in reclamation projects. The whole wetland project area was fully characterized by the City after construction. Soils with moderate concentrations of lead were spread out on and tilled into the agricultural lands just to the south of the project. The wetlands are accessible to the public around the periphery. The Jordan River bike path crosses the river on an historic bridge adjacent to the wetland. The wetland is under study by school children in science projects.

TABLE 1 - ACTION LEVELS USED FOR WETLAND TREATMENT AREA

Contaminant	Range of Concentrations	Fate of sediment/soil
INITIAL REQUIREMENTS (USFWS goal for wildlife protection)		
Pb	>133 ppm	removal offsite
As	>22 ppm	removal offsite
REVISED REQUIREMENTS FOR "HOT" SPOTS (<2 cubic yards)		
Pb	133-499 ppm	stockpile
Pb	500-900 ppm	mixing
Pb	>1000 ppm	offsite
As	22-49 ppm	stockpile

As	50-99 ppm	mixing
As	>100 ppm	offsite
REVISED REQUIREMENTS FOR LARGE AREAS		
Pb	133-199 ppm	stockpile
Pb	200-500 ppm	mixing
Pb	>500 ppm	offsite
As	22-39 ppm	stockpile
As	40-59 ppm	mixing
As	>60 ppm	offsite

Note that the historic channel of the creek, maybe a 100 yards to the north of the old channel, has now been subsumed by the wetland.

The former channel bank on the south side was exposed (not revegetated) and birds had dug burrows into the bank. Several large burrows were present also which the city participants indicated were used by coyotes. The layer with most of the burrows was orangish in color. The topmost layer was white.

There were no recommendations by the group. Later, the state participants decided to test the soils associated with the orange layer which had been used by animals for burrows.

MAY 6, 2003, BLUEWATER REPOSITORIES

Kennecott constructed two soil repositories to contain contaminated soils excavated during their cleanups along Bingham Creek, and later from nearby sites including Lark, South Jordan Evaporations Ponds, Herriman, and Butterfield Canyon. The Bluewater North Repository is filled and is now closed. The Bluewater Main Repository remains open and will be used in the future for disposal of contaminated soils excavated during the course of development. Before 1999, the repositories had their own Ground Water Quality Discharge permit (UGW 350002). Later this permit was included as a part of the "Bingham Canyon Mine and Leach Collection System Permit" (UGW 350010). The repositories are both located in the Bluewater I drainage. As part of the ground water permit, there is a sump and downgradient wells associated with each repository. The ground water information is submitted as a part of the permit requirements. It was not inspected by the site inspection team. Both sites have been revegetated and are in use as open space/wildlife habitat. There was no evidence of cap erosion (soil cap). Participating in the site visit was Doug Bacon (UDEQ), Dave Allison (UDEQ), and Eva Hoffman (EPA). Participating in the interviews and site visit were Jon Cherry (KUCC) and Brian Vinton (NAMS for KUCC).

MAY 6, 2003, LARGE BINGHAM RESERVOIR

The Large Bingham Reservoir Operable Unit (OU4) includes the Large Bingham Reservoir, the Small Bingham Reservoir, and Cemetery Pond. The Large Bingham Reservoir consists of three zones: the Debris Basin; Zone 1; and Zone 2. Beginning in 1992, construction of Zone 1 was done under EPA oversight using emergency response authorities under the terms of an Administrative Order on Consent. Construction of the Debris Basin and Zone 2 was done under the auspices of Kennecott's Ground Water Quality Discharge Permit. The former pond was taken out of service and the sludges and tailings underlying the former reservoir were mixed with lime and soils and then used for reclamation purposes on and under relaxed slopes of the main East Side waste rock dumps. The Small Bingham Reservoir was re-constructed without government oversight in 1990. The sediments from the Cemetery Pond were removed in a voluntary action in about 1994.

Currently, the Debris Basin is used to contain stormwater flow and is permitted for the purpose of drying out sludges (it hasn't been used for this purpose yet). It has a concrete bottom and is mucked out occasionally. The materials mucked out this way are disposed of on the East Side dumps. The last time it was mucked out was 3 years ago. Zone 1 is used to contain meteoric leach water and acid plume water and, as a back up, is permitted for use in storing all other mine waters as needed (it hasn't been used for this purpose yet). Its capacity is about 500 acre-feet. Zone 2 is used for stormwater and is interchangeable with Zone 1. When repairs on Zone 1 are needed, Zone 2 can be used to store acid waters. Its capacity is about 1100 acre-feet.

The participants interviewed Marc Olesen, who is responsible for repairing leaks in the reservoir liners, once they are detected. The leak detection system is the responsibility of Steve Schnoor. Once Mr. Olesen is contacted, there is a visual inspection. Over time, Mr. Olesen has concluded that most of the damages occur along the extrusion welded seams and occur in the winter, due to contraction of the upper liner. Ice is a complicating factor. Damages are repaired using a patch. There has never been a failure of the secondary layer. Part of the reason for the different performance of the two liners could be the installation times. The lower layer was installed in cold weather; the upper layer was installed in the hot summer. The white layer on the top liner is actually a thin layer on a black material. The white does not expand as much as the black substrate. Mr. Olesen indicated that there is some damage to the liner each spring. Last year, the damage involved 10 feet of welds. This year, the damage was especially severe, involving 200 feet. About 3/4 of the 200 feet tear was due to wind damage which occurred above the water line and while the rip was being repaired. The liner was flapping in the breeze. In the last two years, there have been 4 small patches installed in Zone 1 and no repairs needed at all for the Zone 2 liner.

Steve Schnoor explained how Kennecott monitors the leak detection system. The ground water permit for the facility requires that head on each subbasin (5 for each zone for a total of 10) be monitored once a week. Kennecott does their weekly monitoring on Sundays. But the transducers are also connected to the Precipitation Plant building where the head is recorded 24/7. The system is equipped with an alarm. For Zone 1, the maximum allowable head is 4 ft, and the alarm is set at 3.95 feet. For Zone 2, the maximum allowable head is 4.6 feet and the

alarm is set at 4.55 feet. Should an anomaly be found, there are a series of action items that Mr. Schnoor conducts, including turning on the pump in the sump while watching the head readings. He can also begin to transfer the water out of the reservoir into the other zone or to the tailings pipeline. The pressure transducer readings are fed into a digital database so that trends can be observed. The data base includes readings taken every 15 minutes.

Sludge buildup in the reservoir is currently at 6 - 10 feet in Zone 1 and 1 - 2 feet in Zone 2. The sludge should not exceed 20 feet (a value which would seriously impact storage capacity of the reservoir).

The Small Reservoir is now used as an extra water storage area for tailwaters. Its capacity is 84 acre-feet and contains about 20 acre-feet currently. The Cemetery Pond area is slated to become the junction point where Kennecott delivers water to the Jordan Valley Water Conservancy District as part of the OU2 project. It is not used currently.

MAY 6, 2003, BINGHAM CANYON HISTORIC FACILITIES

Most of the Bingham Canyon Historic Facilities covered in the 1998 were either subsumed by the pit or buried with waste rock long ago. However, there were a few facilities which still had footprints visible in the canyon either with cribbing or relic foundations. With only a few exceptions, these remaining facilities are due to be buried with waste rock in the near future. The participants (Jon Cherry, Brian Vinton, Eva Hoffman, Doug Bacon, and Dave Allison) visited the canyon. During the visit, Kennecott workers were busily removing infrastructure from the canyon including the rails and utilities in preparation for the imminent burial of the canyon. Kennecott staffers pointed out the location where the new toe of the dump would be located and provided a map. The facilities soon to be buried include the footprint of the original Utah Copper Mill, the West Mountain Placer Shaft, the "new" ore loading area, the Dry Forks tunnel, and the Dry Forks shops. A temporary building has been erected close to the reservoirs for storage of the equipment and spare parts formerly located at the Dry Forks Shops.

The new toe of the dump will still be located upgradient of the Precipitation Plant and Bingham Creek cut off wall. The site of the former uranium secondary recovery plant will also be unaffected. The footprint of the uranium plant is an open unfenced field vegetated with weeds. The radioactivity and the trace metals were totally removed during the closure and subsequent cleanup, and there are no restrictions on the use of the land.

MAY 6, 2003, COPPERTON SOILS

There are several new houses which have been built on the east side of 5th E in Copperton. This is in the area of Copperton Circle which was a former tailings pond. EPA's initial characterization located these tailings, but found that the tailings were copper tailings, not lead tailings. The concentrations of lead and arsenic were low. Although there are some new houses in the area, there are no new causes for concern. The land at the south end of Copperton Circle where formerly tailings were exposed is still fenced off and undeveloped. The land to the east of Copperton Circle is currently in open space and industrial use. There are some wetlands

areas in this parcel.

MAY 7, 2003, NEW DEVELOPMENT PROJECTS IN WEST JORDAN

David Murphy (Public Works, West Jordan), _____ (Public Works, West Jordan), Doug Bacon (UDEQ), Ron Segura (BOR for EPA), and Eva Hoffman (EPA) gathered at West Jordan City Hall to review new (after the cleanups) construction projects conducted by the city, county, and private developers. The goal of the meeting was to determine if additional samples were needed, or if sufficient post construction sampling had already taken place under city auspices to assess if wastes had been exposed during the construction. Following the meeting, Segura, Hoffman and Bacon visited each site and tentatively chose sample locations. The list of projects and the determination of sampling needs are given in Table 2.

TABLE 2: STATUS OF NEW CONSTRUCTION PROJECTS
ALONG BINGHAM CREEK IN WEST JORDAN

Project/Development (going upstream)	Existing Data	Sampling Needs for 5-yr
15. West Jordan City constructed wetlands and storm drain project (SE of rail crossing of 7800 S)	full documentation, both pre and post construction	None [State later decided to collect a few XRF samples along the southern bank of the old creek channel. Although not part of the wetlands project, there were some animal burrows observed in the orange layer.]
14. Salt Lake County Flood Control project (along 8050 South lane from Bingham Creek to Jordan River)	The city did not request data from the county. See Brent Beerdall to determine if data exists.	None
13. West Jordan City 1240 W Sanitary Sewer Project (8200 to 8050 S along east side of creek)	full documentation, both pre and post construction: The levels were low and suitable for potential residential use in the future. There was a layer of contamination 1.5 - 2 feet down. This layer added 10% to the cost of the project. Contamination put back into the hole.	None

12. Sugar Creek Condos (1900 West Sugar Factory Rd)	no soils report was required, although some might exist when original sewer put in. Also there was a notice given to them in the pre-construction meeting. Construction was along the top berm of the creek - it did not get into the creek bed (5-10 feet inside)	Yes. Two or three samples along the back fence. The fence abuts to bank of creek. The bank was not affected by the construction.
11. Salt Lake County Youth Justice Center (2200 West Sugar Factory Road)	There was no file for this. Don't know if this was sampled. It was slab on grade construction over the old creek channel. There was a sewer lateral dug.	Yes. Two grab sample from stressed area just west of the asphalt parking lot, and one sample in front flower bed where the sewer went into the building.
10. Two duplexes on Sugar Factory Rd.	no sampling done. Creek is along the property line in back.	Yes. One sample behind each building, if possible, from the backyard.
9. Bingham Creek Storm Drain Project (2700 to 2200 W thru creek) SL County and West Jordan City	See SL County Beerdall	Yes, One sample at NE corner (where the new curbing is), and one sample at NW corner near the fence. Also a grab on the road base at the centerline of the new box culvert at 2700 W, and one on the other side of the road also.
8. Mountain View Townhomes(8550 S 2700 W)	Did require sampling and the results were OK	no
7. Mountain View Business Park - (8600 S 2900 W)	The original data was in the file and there was a note about the sewer lateral, but the sewer lateral is under the roads now.	no
6. Cascade Springs Apartments (8600 S 2800 W)	The original fill was from the Bangerter Hwy, and some extra fill came from offsite	yes, 5 cross-sections

5. City waterline (10") for Cascade Springs Apartments	The materials were supposed to be put back in the hole, most was covered with asphalt	yes, grab behind the cinder block structure.
4. The Woods at Creekview 3B Subdivision (3200 W 8800 S)	Don't know, a few new homes, but the eastern end has not been developed yet	yes, at new homes near creek
3. Jordan Valley Hospital Expansions (3600 W 9000 S)	no digging, just fill	no
2. Salt Lake Community College ballfield (3600 W 9000 S)	no digging, just fill	no
1. Marketplace at Naylor Farm (4000 W 9000 S)	Nothing built yet	no

MAY 7, 2003, CHANGES IN OWNERSHIP OF CLEANED UP PROPERTIES IN WEST JORDAN

The City of West Jordan prepared a list of current owners of Bingham Creek Properties and compared that list with the ownership at the time of cleanup. Of the 93 parcels listed, 36 of the properties had changed ownership since the original cleanup (39%).

FUTURE ACTIVITIES

Sampling of the new developments as designated by the city, state, and federal representatives will start on May 12, 2003. The sampling will be performed by Ron Segura, of the U. S. Bureau of Reclamation, Provo Office, using funds from the existing Interagency Agreement between USBR and EPA. The Bureau will use a pre-existing Sampling and Analysis Plan used at this site previously amended to add the new locations. In general, the samples will be analyzed using XRF with 10% of the samples sent to a commercial lab for confirmation using atomic absorption techniques.

DOCUMENTS RECEIVED DURING SITE VISIT

Kennecott Utah Copper, "Bingham Canyon Waste Rock Placement, 1998, 2003, and Final", a map showing toe of the dumps.

City of West Jordan, List of Remediated Properties, Current and Former Ownership, 2003.

Applied Geotechnical Engineering Consultants to City of West Jordan, Results of Chemical Analyses of soils along the sewer line project at 1240 W (pre-construction), January 17, 2003.

Applied Geotechnical Engineering Consultants to City of West Jordan, Results of Chemical Analyses of soils along the sewer line project at 1240 W (post-construction), April 15, 2003.

Applied Geotechnical Engineering Consultants to City of West Jordan, Results of Chemical Analyses of residues on plastic sheeting used to stockpile soils unearthed during construction of the sewer line project at 1240 W, April 8, 2003.

Applied Geotechnical Engineering Consultants to the City of West Jordan, Results of Chemical Analyses of soils along the sewer line project between 8050 South and 8150 South, April 3, 2003.

Gilmore Engineering, Plan and Profile for Sewer Line between 8050 South and Beckstead Lane, no date given.

City of West Jordan, Results of Chemical Analyses of Soils and Waters at the Wetlands Project near the intersection of Bingham Creek and the Jordan River, 2002.

City of West Jordan, List of Major Projects in Bingham Creek Area Remediation Zone, 2003.

Kennecott Utah Copper, Excerpts from "1999 Annual Operational Monitoring Report, Bingham Canyon Mine and Leach Collection System Groundwater Discharge Permit", Bluewater Repository Activities, April, 2000.

Kennecott Utah Copper, Chemical Analyses Results for P272, Time Series Graphs for P248B, Chemical Analyses Results for P248B, Time Series Graphs for P248A, Time Series Graphs for P244C (Wells downgradient of Bingham Creek Cut-off Wall, and Keystone and North Copper Walls), March, 2003.

Kennecott Utah Copper, Depth to Water Time Series B1G951, Sulfate Time Series Graph B1G951 and associated data, Depth to Water Time Series K84, Sulfate Time Series Graph K84, and associated data, (wells downgradient of the Large Bingham Reservoir), May 7, 2003.

Kennecott Utah Copper, Example of Weekly Inspection Form for Desilting Basin, Zone 1 and Zone 2, one set of normal reports and an example of abnormal report, 2002.

Kennecott Utah Copper, Depth to Water, flows, and chemical time series, Bluewater Main Repository Sump (BRP1476), and Bluewater North Repository Sump (BRP292).

Utah Department of Environmental Quality, "Final Permit, Statement of Basis, and Appendices; Bingham Canyon Mine and Leach Collection System; Permit No. UGW350010," 1999.

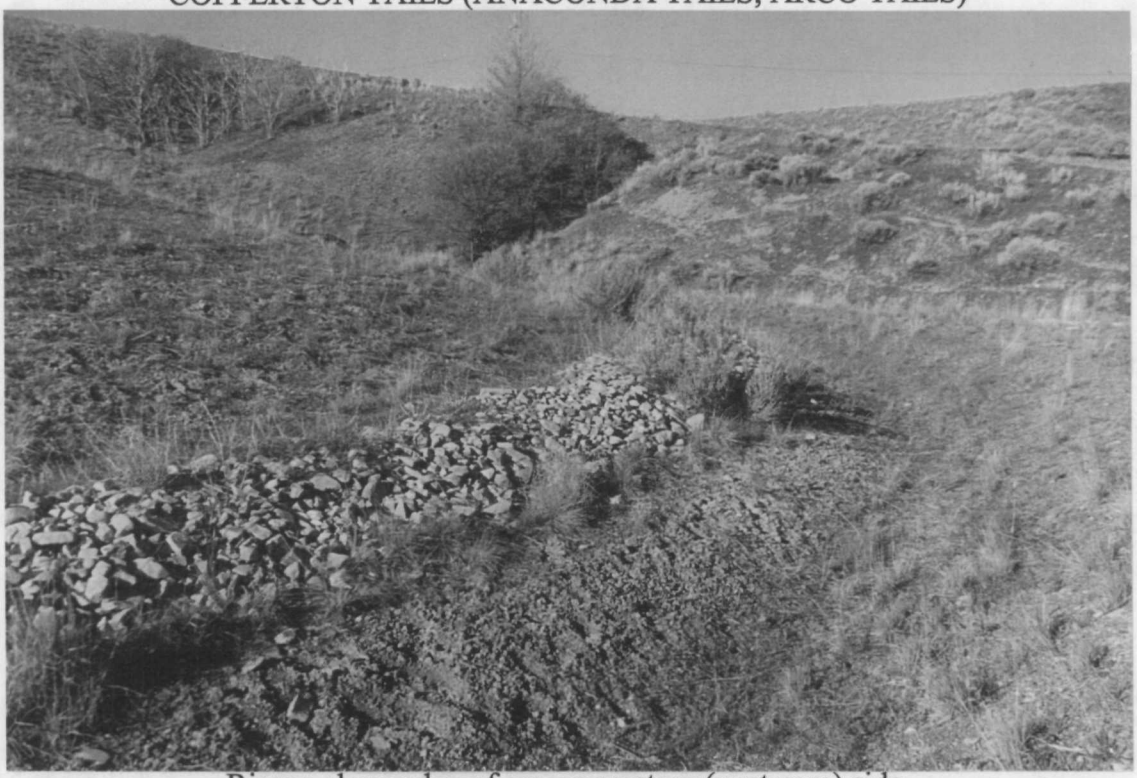
Utah Department of Environmental Quality, "Final Renewal of Ground Water Discharge Permit - Large and Small Reservoir permit - 350006," 2000.

Color Photo(s)

The following pages contain color that does not appear in the scanned images.

To view the actual images, please contact the Superfund Records Center at (303) 312-6473.

PHOTO SHEET #1
COPPERTON TAILS (ANACONDA TAILS, ARCO TAILS)

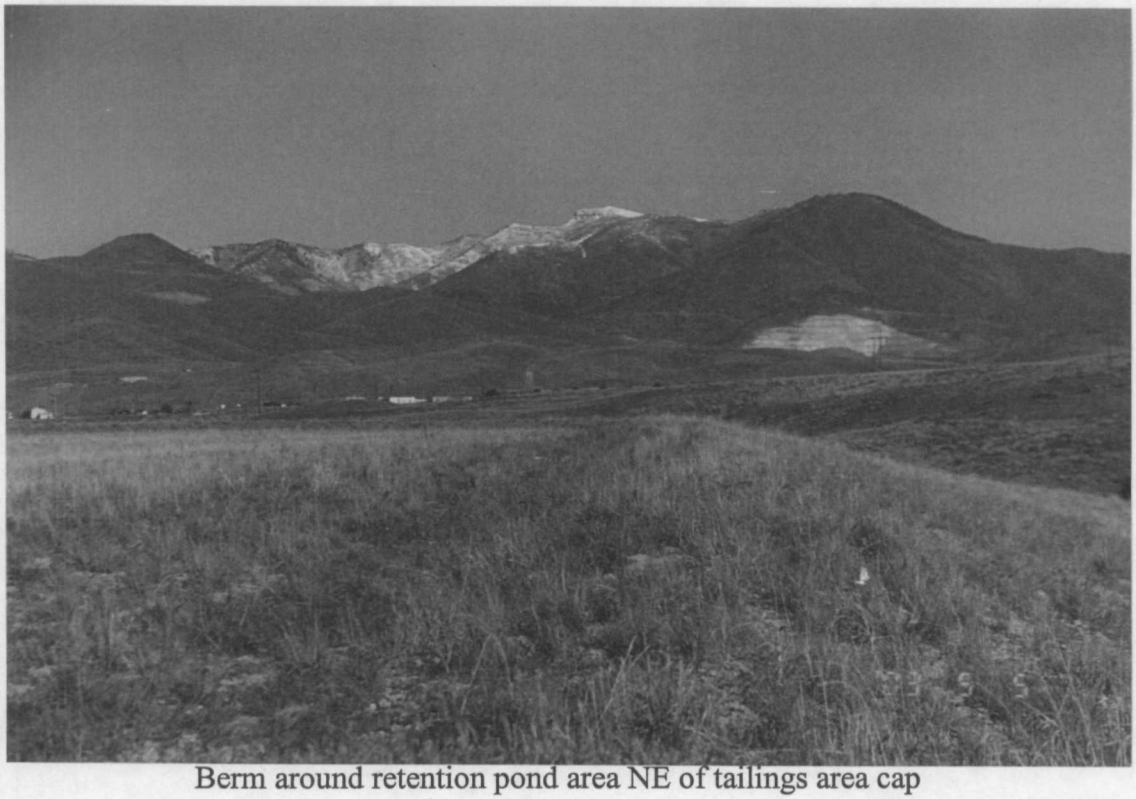


Riprap along edge of cap on western (upstream) side.

Large Bingham Reservoir Dam from tailings pond showing riprap on the upstream side

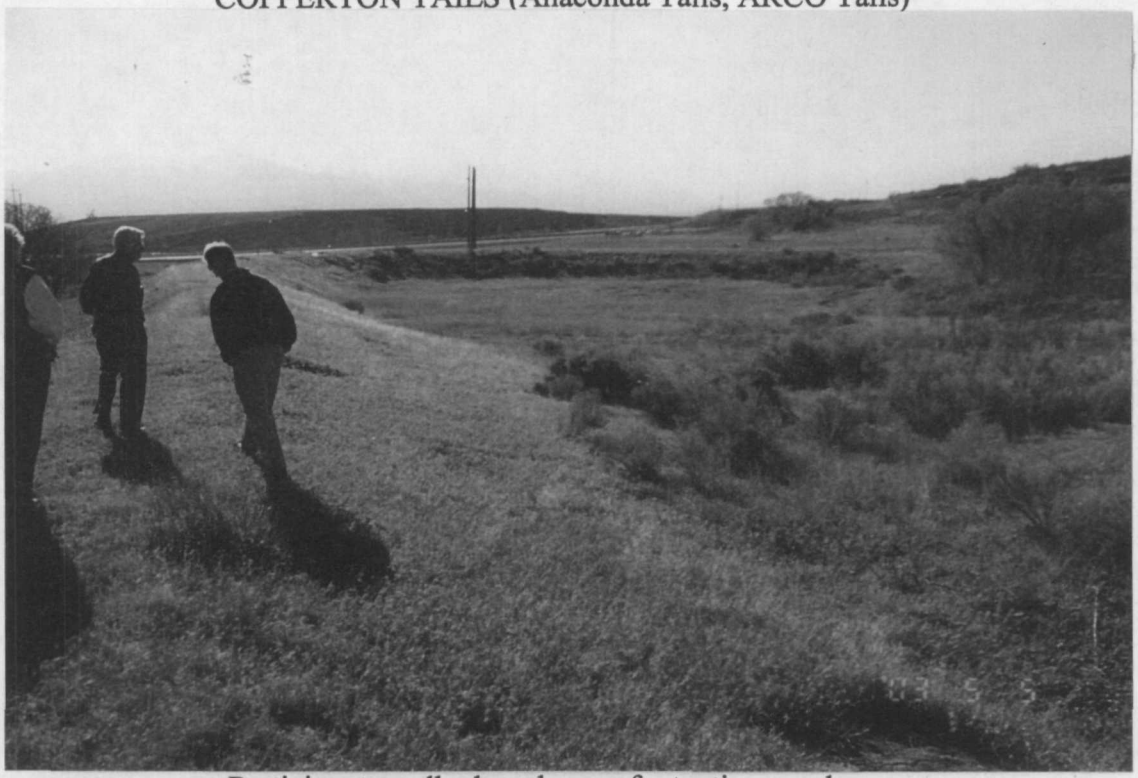
PHOTO SHEET #2

Riprap and drainage ditch from NE corner of cap to retention pond area



Berm around retention pond area NE of tailings area cap

PHOTO SHEET #3
COPPERTON TAILS (Anaconda Tails, ARCO Tails)



Participants walk along berm of retention pond area

Tree in retention pond area with an owl nest in it

PHOTO SHEET #4
COPPERTON TAILS (Anaconda Tails, ARCO Tails)

Participants walking along berm of the retention pond

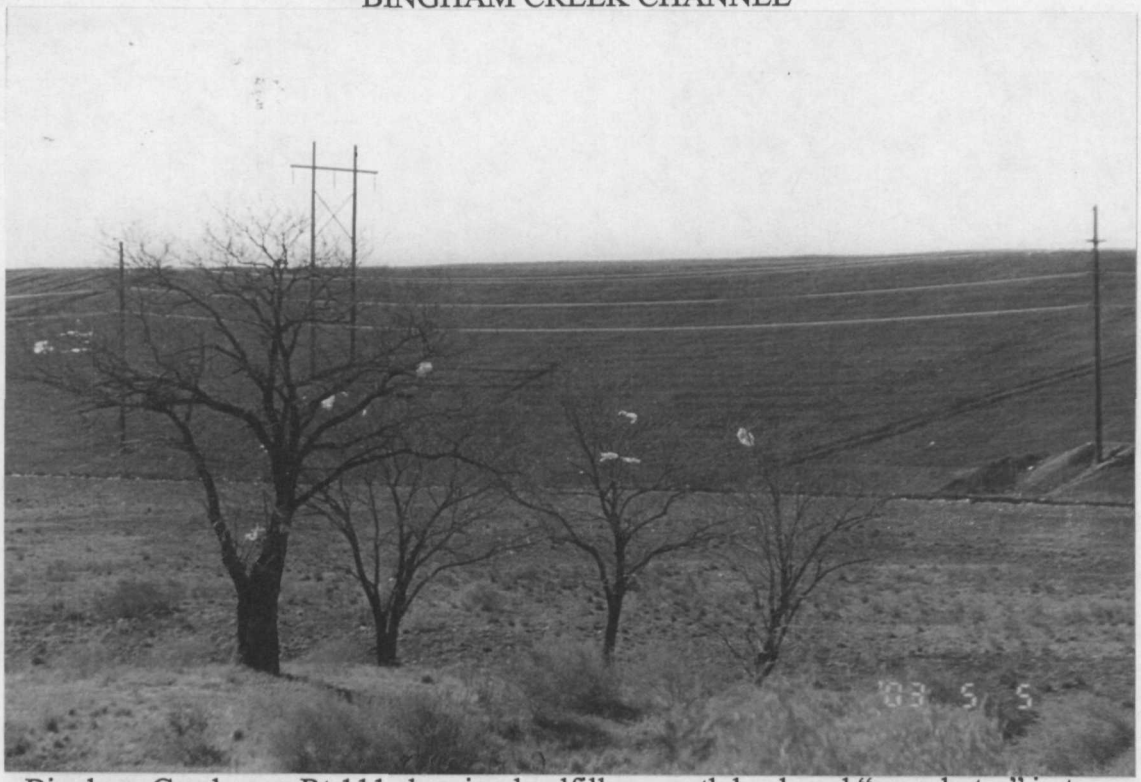
Retention Pond overflow chute showing deer hoof print marks

PHOTO SHEET #5

COPPERTON TAILS (Anaconda Tails, ARCO Tails)

Retention Basin, revegetation with grass, trees

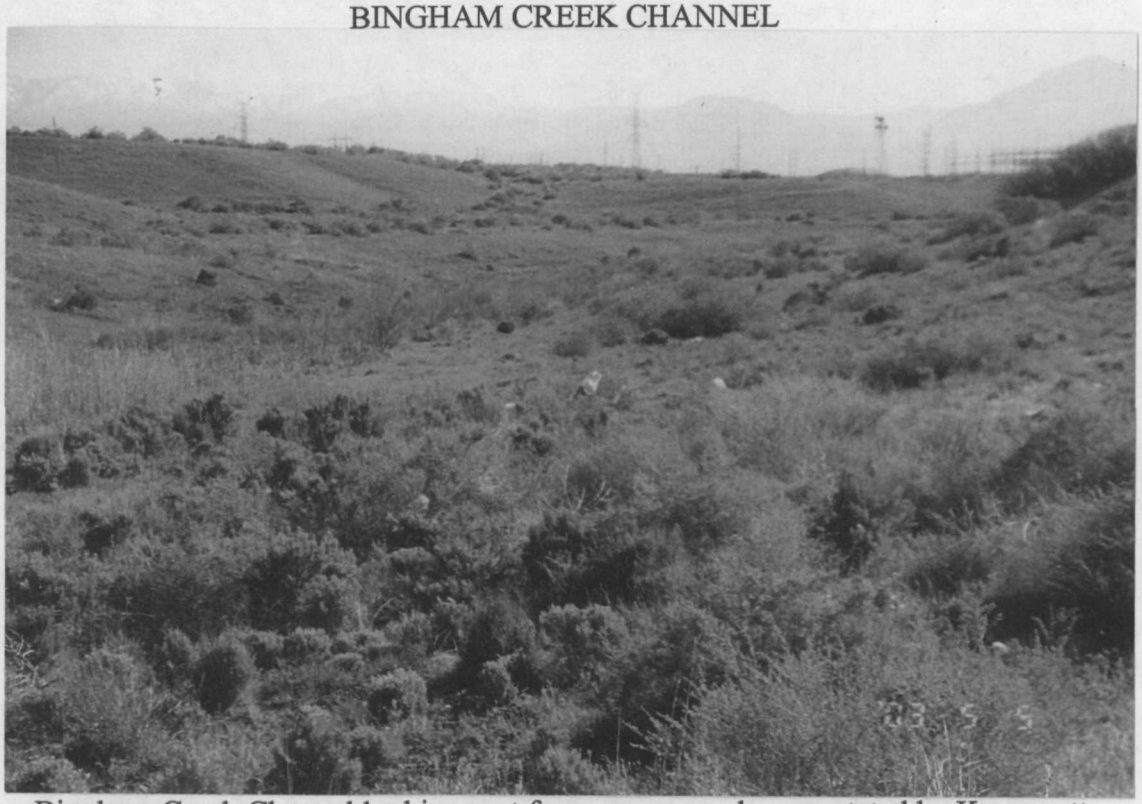
PHOTO SHEET #6
BINGHAM CREEK CHANNEL



Bingham Creek near Rt.111 showing landfill on south bank and "parachutes" in trees

Bingham Creek culvert under access road near power substation at eastern boundary of Zone 19, revegetation

PHOTO SHEET #7
BINGHAM CREEK CHANNEL



Bingham Creek Channel looking east from access road, revegetated by Kennecott

Gully forming in banks of Bingham Creek near intersection with Rt. 111.

PHOTO SHEET #8
BINGHAM CREEK CHANNEL

Ditch from highway and access road leading to erosion gully to Bingham Creek

Channel near Bingham Flats (with "parachutes")

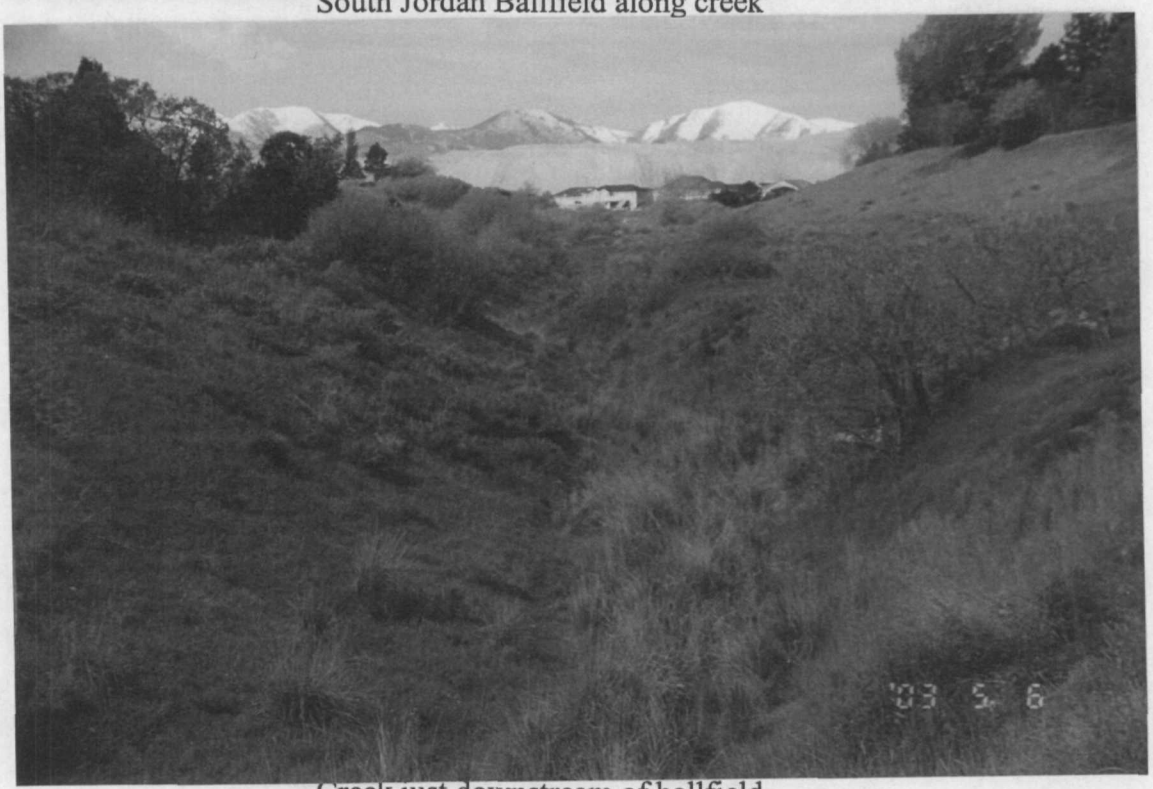
PHOTO SHEET #9
BINGHAM CREEK CHANNEL

Bingham Creek Channel adjacent to Bingham Flats

Bingham Flats

PHOTO SHEET #10
BINGHAM CREEK CHANNEL

South Jordan Ballfield along creek



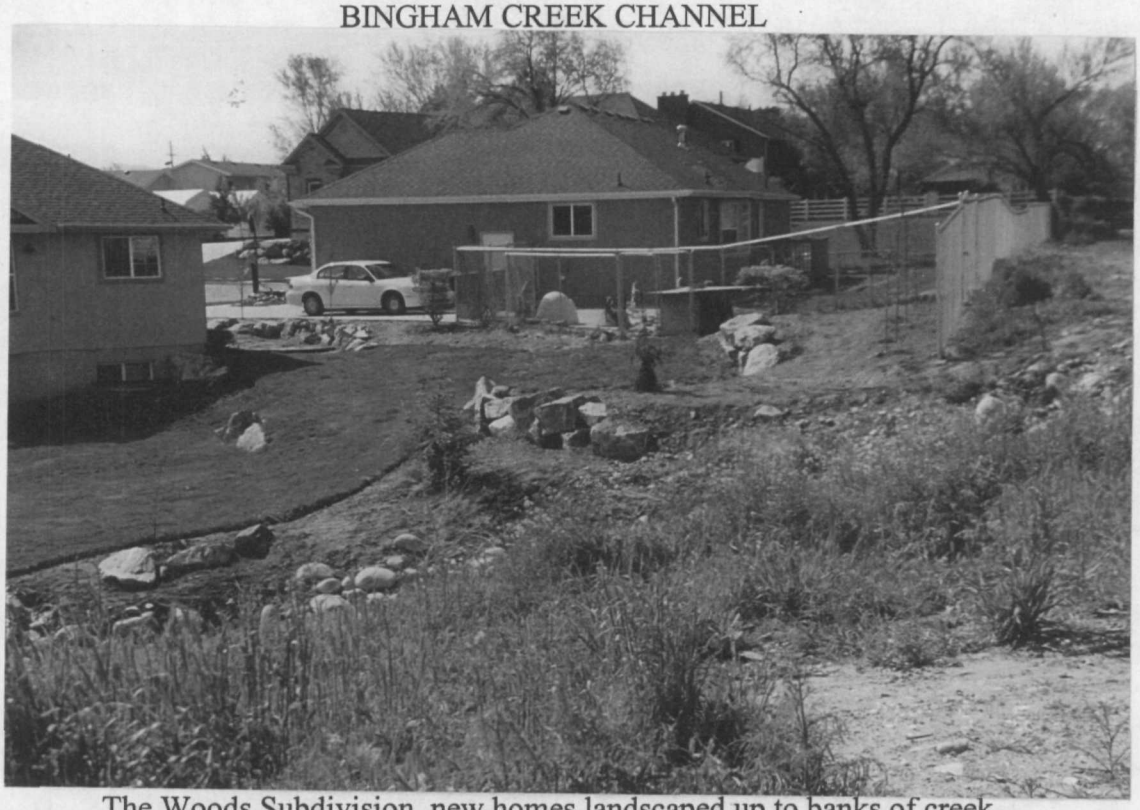
Creek just downstream of ballfield

PHOTO SHEET #11
BINGHAM CREEK CHANNEL

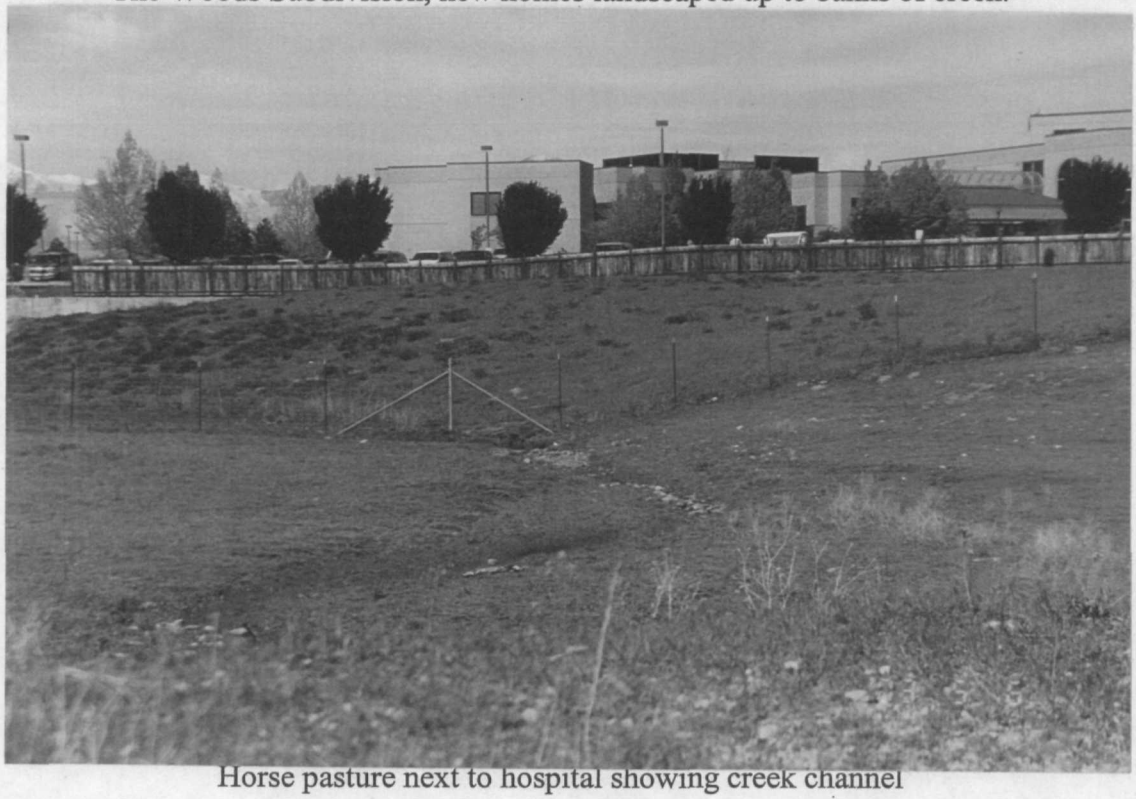
Park behind homes in South Jordan

The Woods Subdivision new houses back up to creek channel near hospital

PHOTO SHEET #12
BINGHAM CREEK CHANNEL

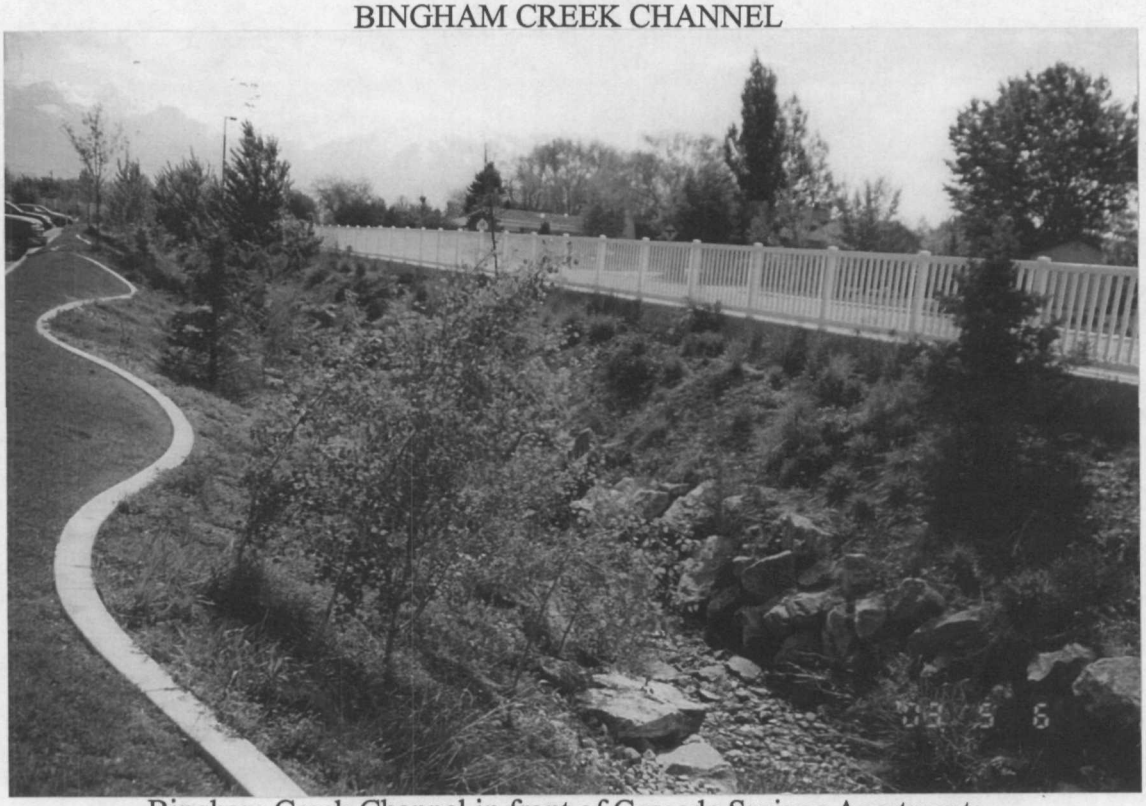


The Woods Subdivision, new homes landscaped up to banks of creek.



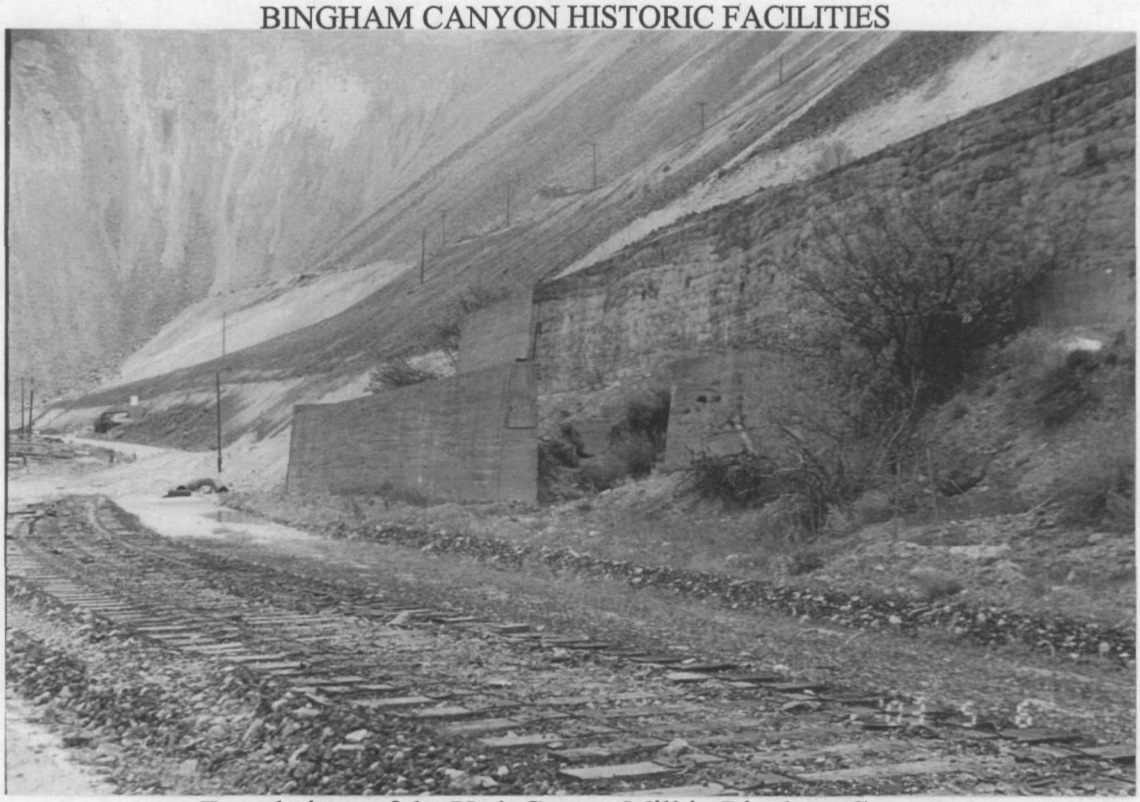
Horse pasture next to hospital showing creek channel

PHOTO SHEET #13
BINGHAM CREEK CHANNEL

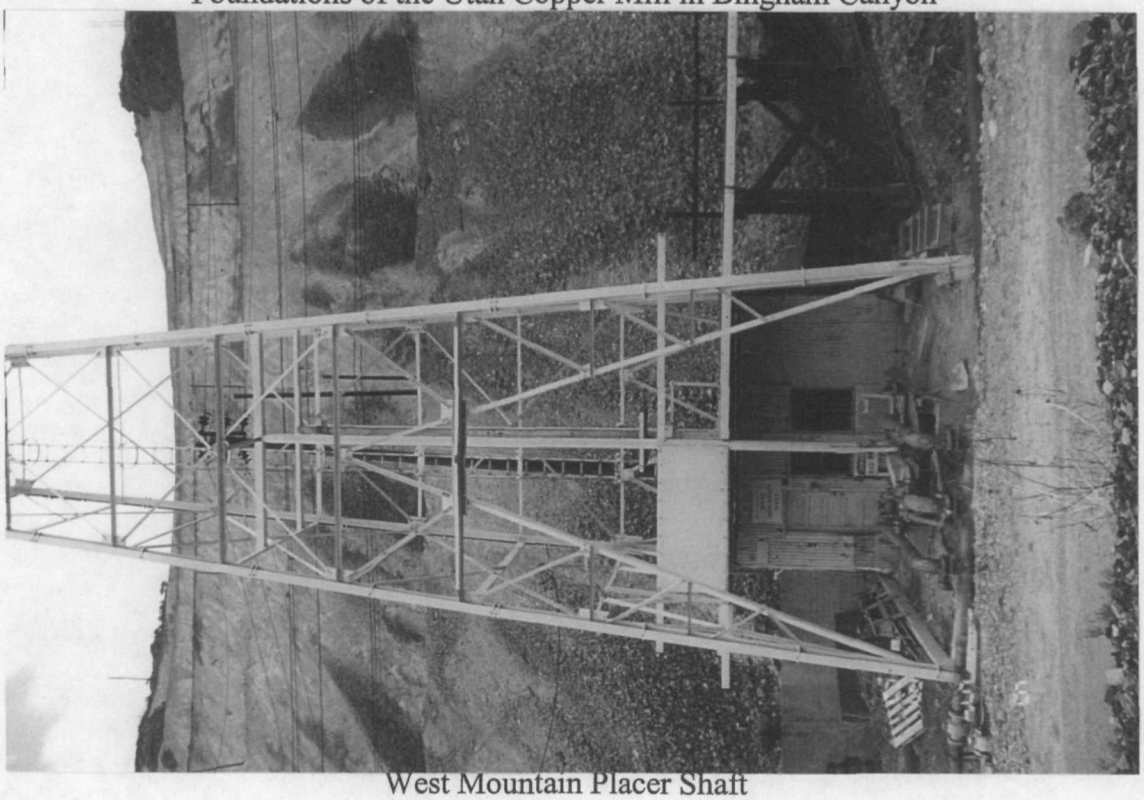


Bingham Creek Channel in front of Cascade Springs Apartments

PHOTO SHEET #14
BINGHAM CANYON HISTORIC FACILITIES



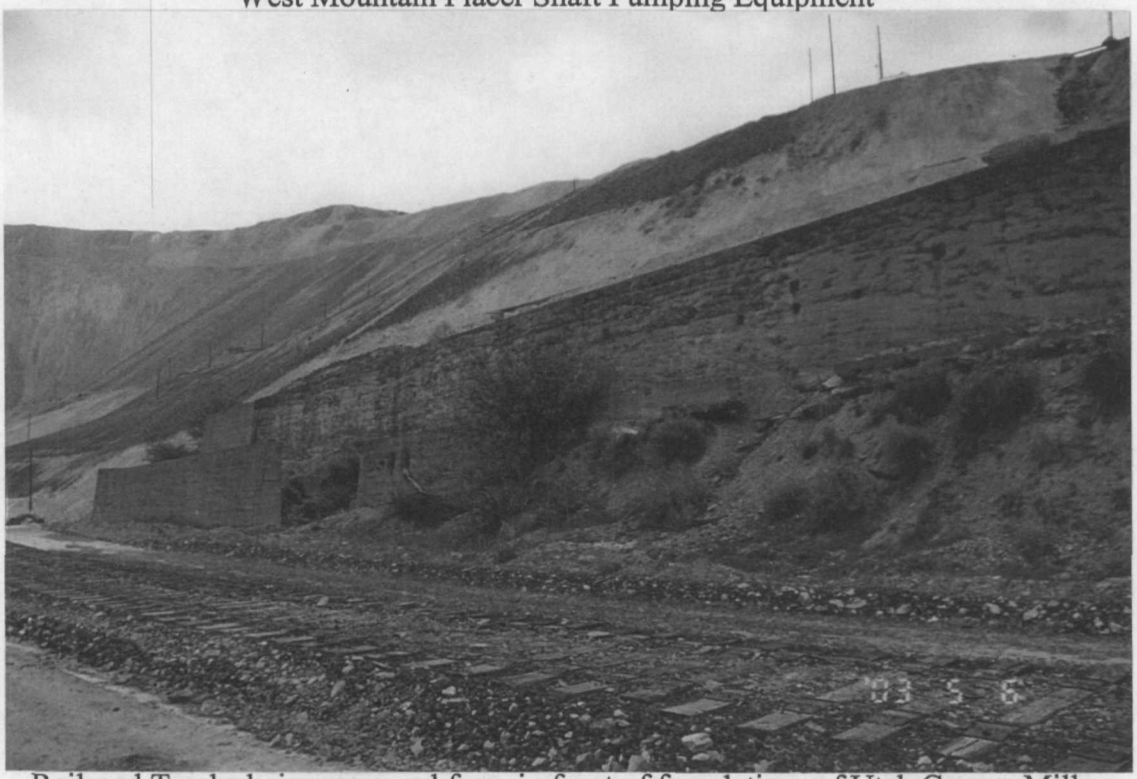
Foundations of the Utah Copper Mill in Bingham Canyon



West Mountain Placer Shaft

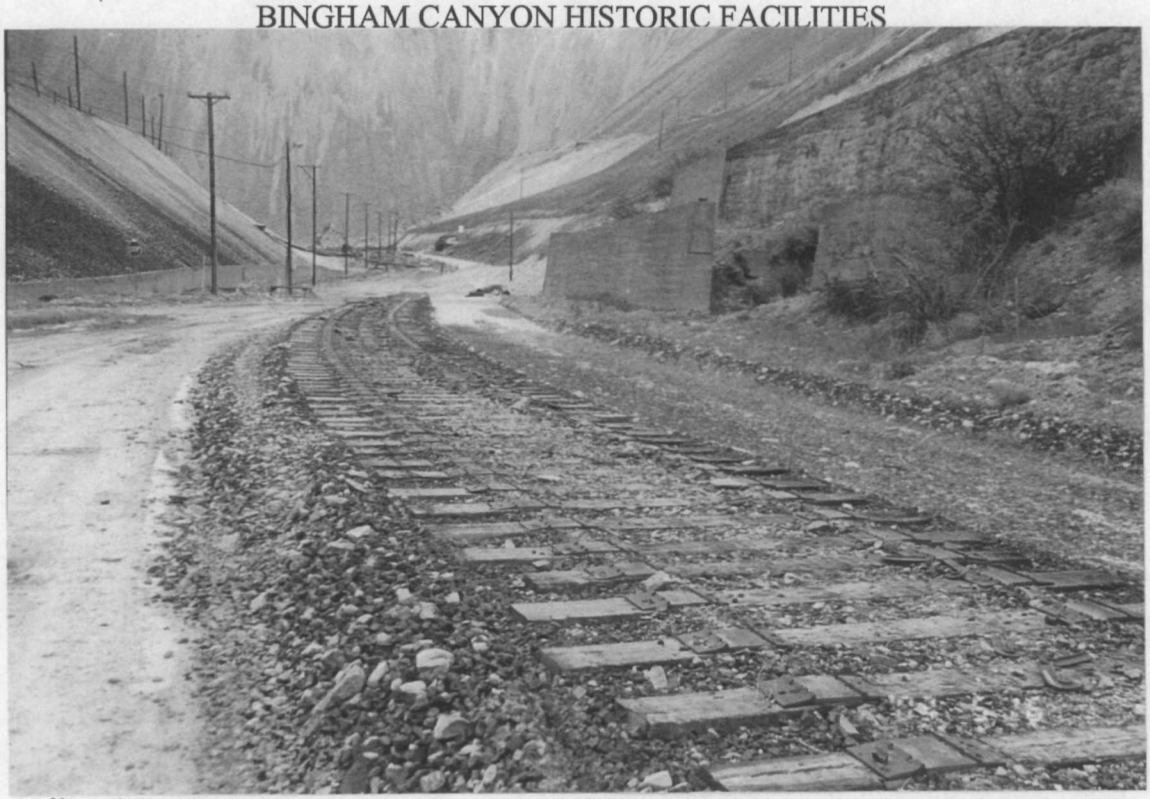
PHOTO SHEET #15
BINGHAM CANYON HISTORIC FACILITIES

West Mountain Placer Shaft Pumping Equipment



Railroad Tracks being removed from in front of foundations of Utah Copper Mill

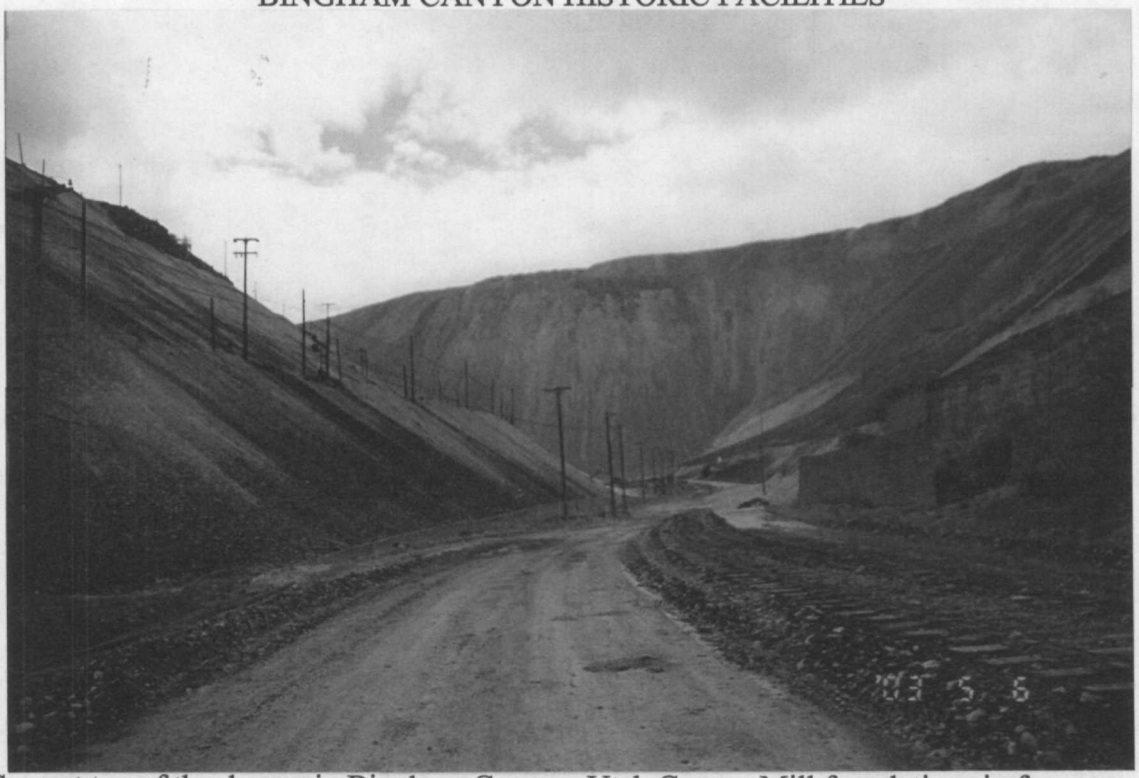
PHOTO SHEET #16
BINGHAM CANYON HISTORIC FACILITIES



Railroad Tracks being removed from area in front of foundations of Utah Copper Mill

Railroad Tracks being removed, downgradient of Utah Copper Mill site

PHOTO SHEET #17
BINGHAM CANYON HISTORIC FACILITIES

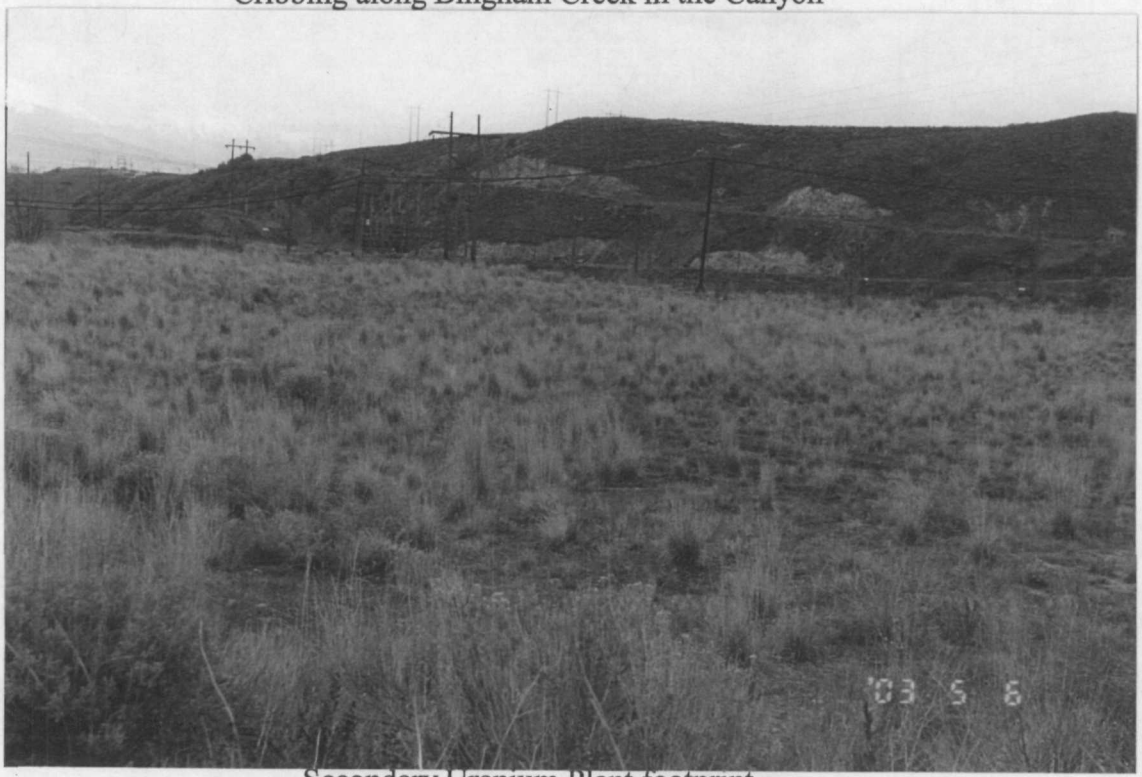


Current toe of the dumps in Bingham Canyon, Utah Copper Mill foundations in foreground

Dry Fork Tunnel and current toe of the dumps

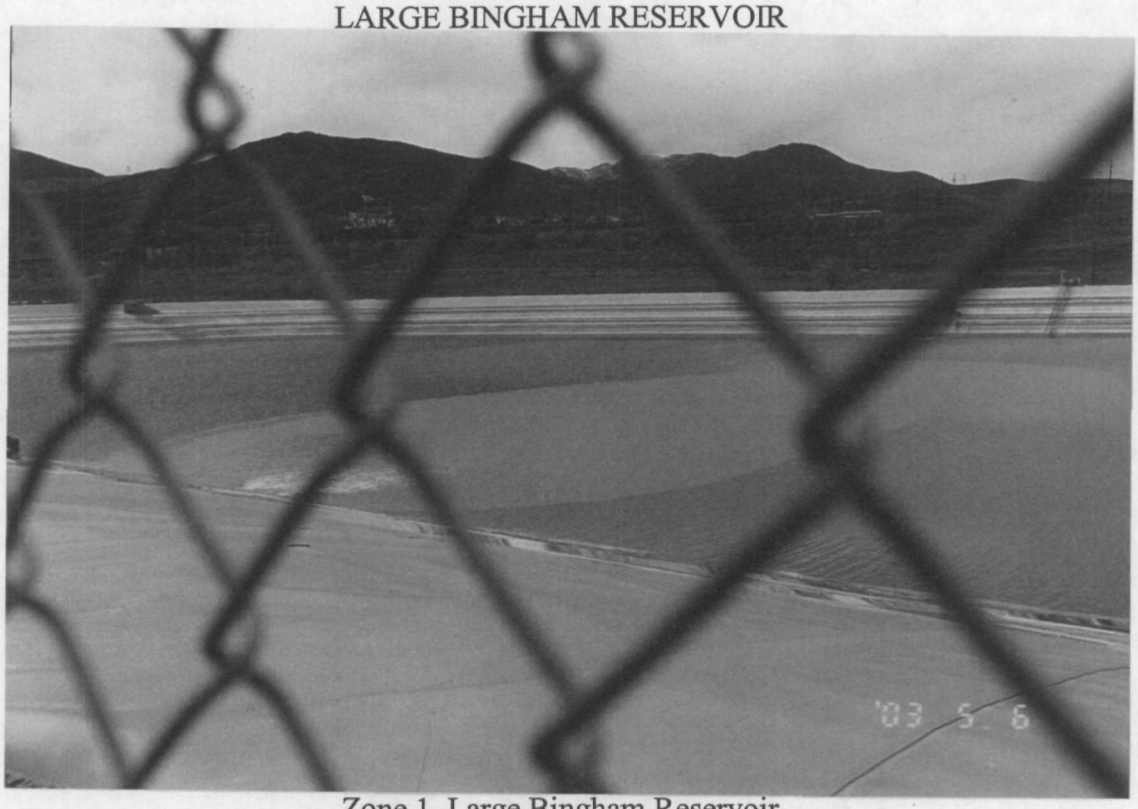
PHOTO SHEET #18
BINGHAM CANYON HISTORIC FACILITIES

Cribbing along Bingham Creek in the Canyon



Secondary Uranium Plant footprint

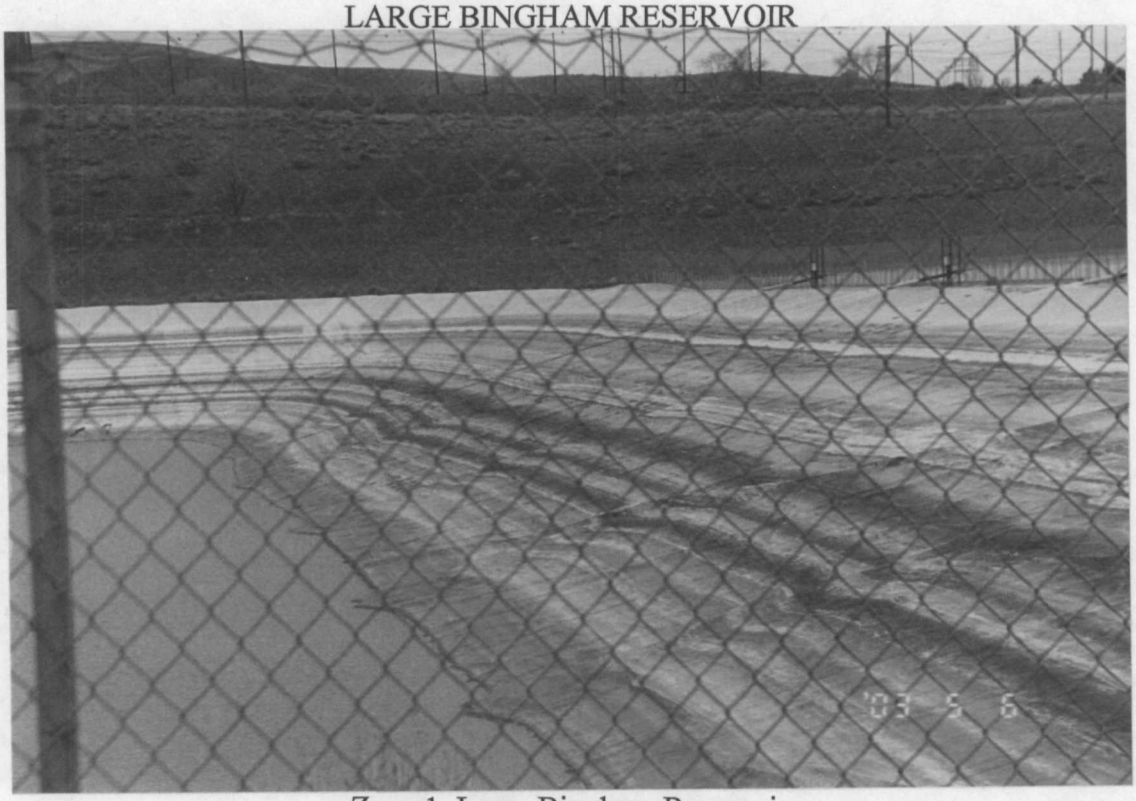
PHOTO SHEET #19
LARGE BINGHAM RESERVOIR



Zone 1, Large Bingham Reservoir

Zone 1, Large Bingham Reservoir

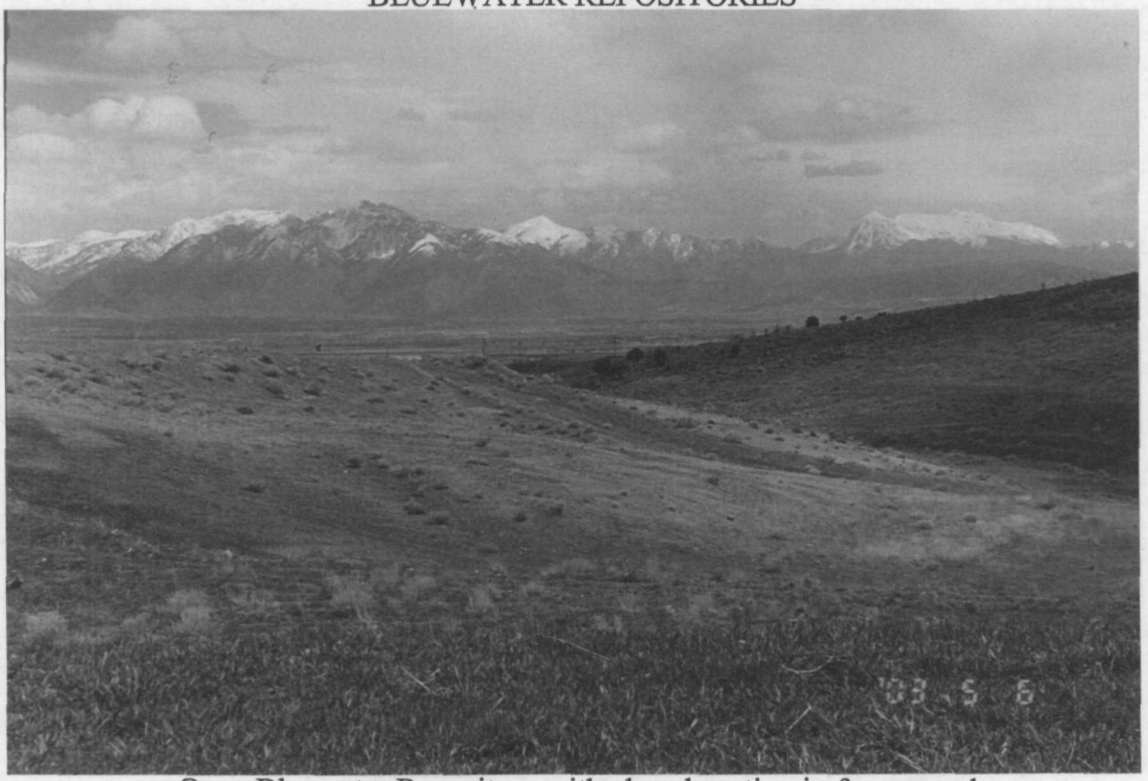
PHOTO SHEET #20
LARGE BINGHAM RESERVOIR



Zone 1, Large Bingham Reservoir

Relaxed Slope of Dumps where sludge, lime, soils mixed and used for the slope

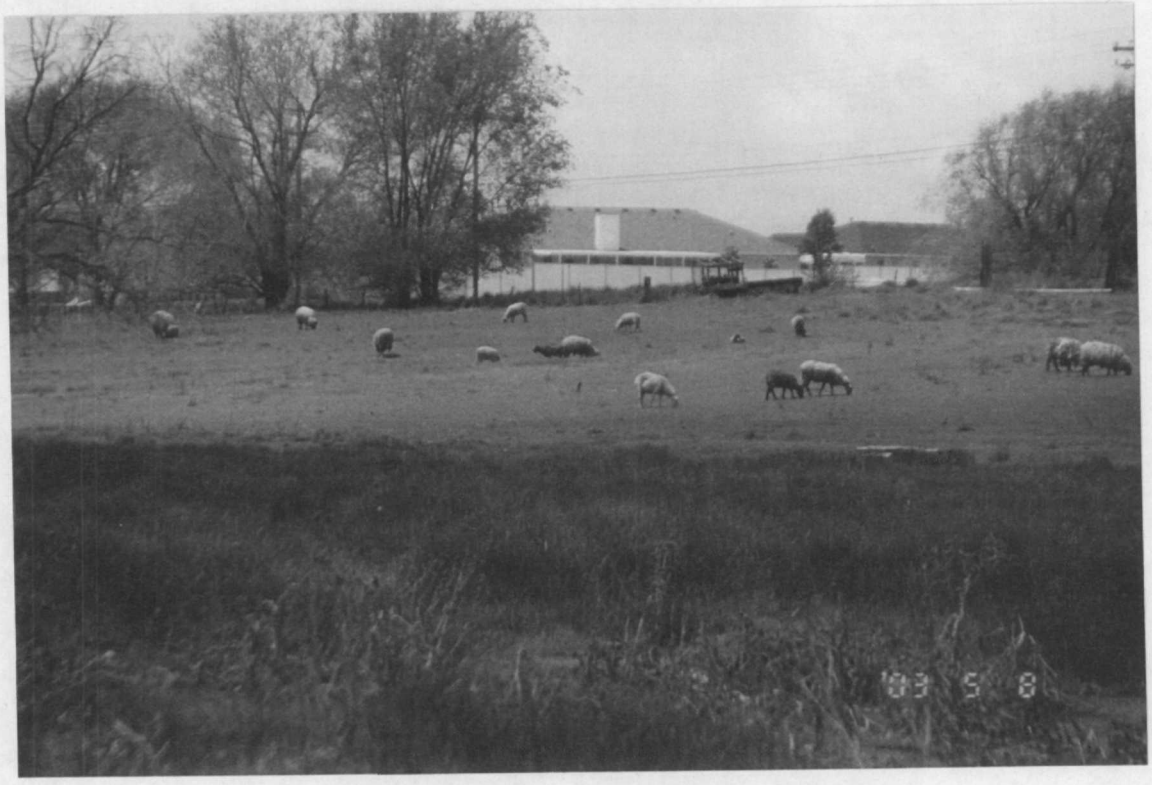
PHOTO SHEET #21
BLUEWATER REPOSITORIES



Open Bluewater Repository with closed portion in foreground.

PHOTO SHEET #22
LOWER BINGHAM CREEK

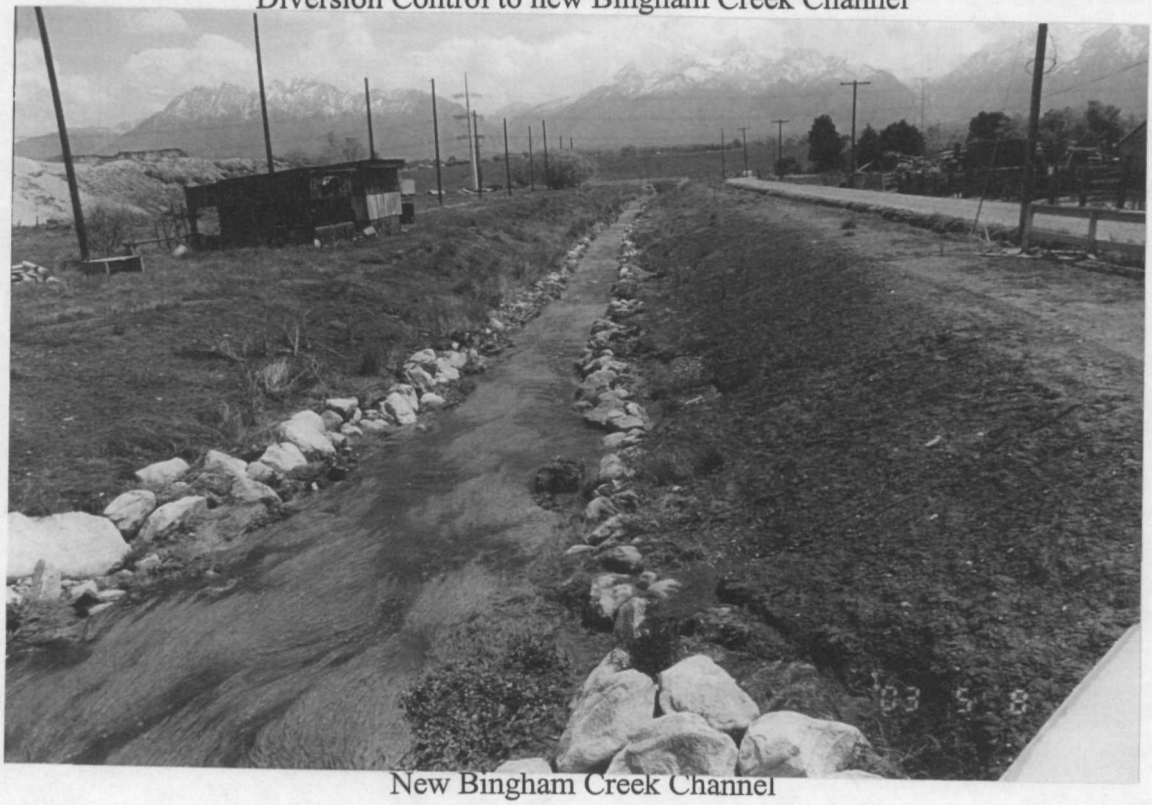
Lower Bingham Creek just upstream of new channel, diversion control shown at right.



Agricultural land near lower Bingham Creek

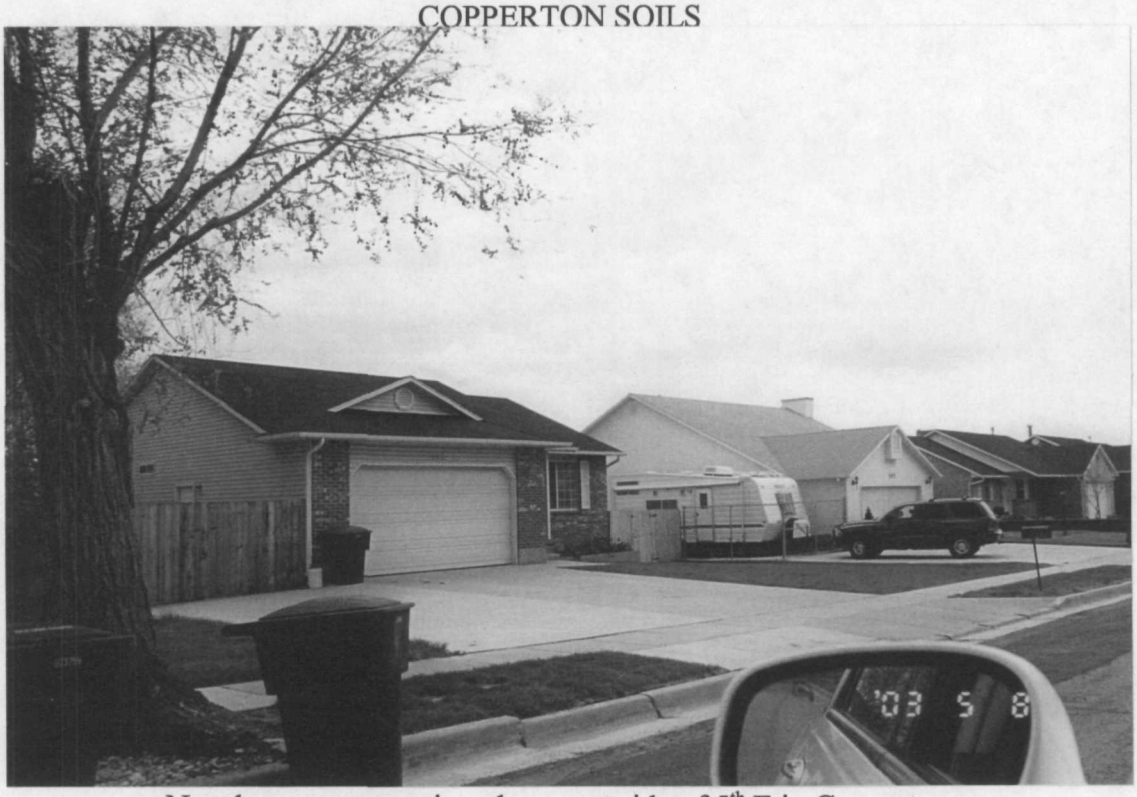
PHOTO SHEET #23
LOWER BINGHAM CREEK

Diversion Control to new Bingham Creek Channel



New Bingham Creek Channel

PHOTO SHEET #24
COPPERTON SOILS



New home construction along east side of 5th E in Copperton

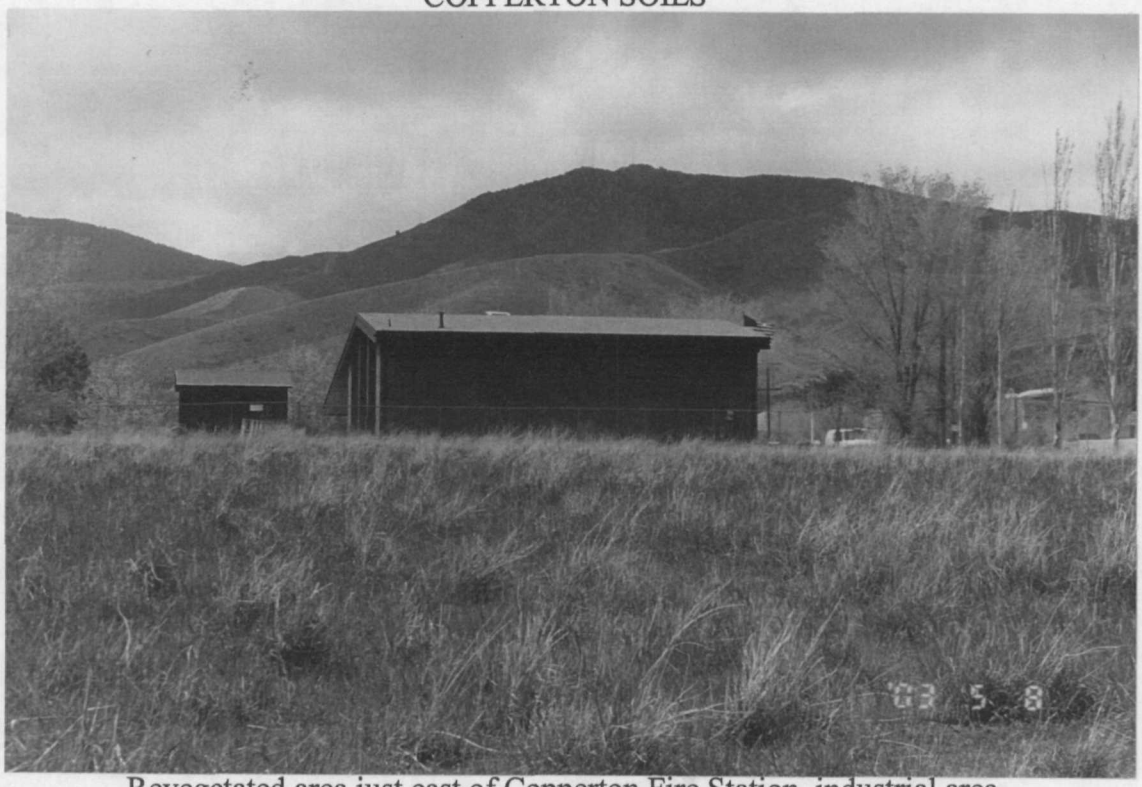
South end of Copperton Circle, tailings area still shows stressed vegetation

PHOTO SHEET #25
COPPERTON SOILS

Industrial area just to the east of Copperton Circle

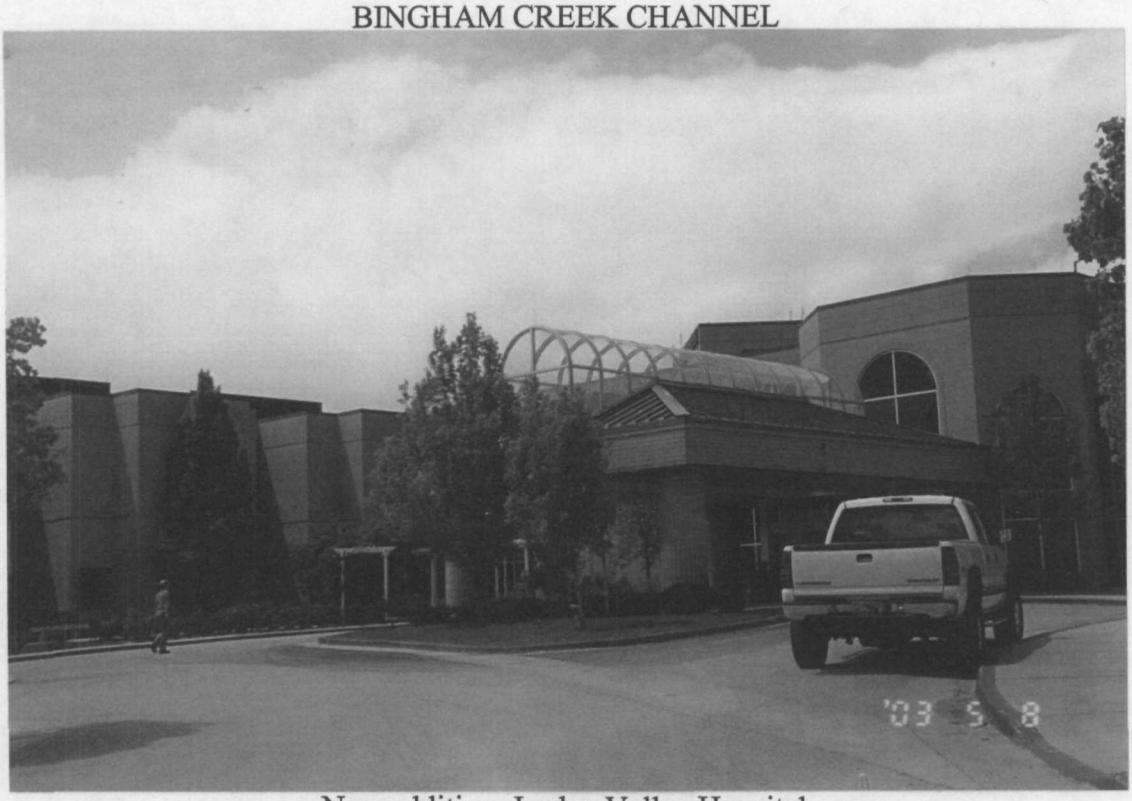
Wetland area in industrial zone just to the east of Copperton Circle

PHOTO SHEET #26
COPPERTON SOILS



Revegetated area just east of Copperton Fire Station, industrial area

PHOTO SHEET #27
BINGHAM CREEK CHANNEL



New addition, Jordan Valley Hospital

New landscaping area in the Woods subdivision, creek is at edge of dirt.

PHOTO SHEET #28
BINGHAM CREEK CHANNEL

New Home in The Woods Subdivision, channel on the extreme left.

Bakery in new Mountain View Industrial Park

PHOTO SHEET #29
BINGHAM CREEK CHANNEL

Creek channel is just this side of fence line, Sugar Creek Condos.

APPENDIX D
LETTER FROM KENNECOTT TO CITY OF SOUTH JORDAN ABOUT EROSION GULLY IN CREEK

Kennecott Utah Copper Corporation
Environmental Engineering Projects Group
8400 West 10200 South
P.O Box 112
Bingham Canyon, Utah 84006-0112
(801) 569-6810
FAX (801) 569-6854

Kennecott

May 30, 2003

Steven Noble
South Jordan Public Works
10996 S Redwood Road
South Jordan, Utah 84095

Dear Steve,

Kennecott Utah Copper Corporation (KUCC) was asked by the United States Environmental Protection Agency (EPA) to work with the responsible parties to remedy the erosion problem that has developed on KUCC property from runoff water along the east side Highway 111 and the TransJordan landfill. The water has been channeled onto KUCC property and into Bingham Creek causing a gully to develop on the south side of Bingham Creek in a former soil removal/clean up area Dwayne Woolly, Manager of the TransJordan Landfill has told KUCC that South Jordan has asked for a letter from KUCC authorizing South Jordan and TransJordan to access KUCC property to excavate a trench and place a pipe to fix this erosion problem. This 15 inch HDPE corrugated pipe will be placed so it can receive the water from the existing South Jordan drain pipe The pipe will be located immediately east and adjacent to the chain-link fence on KUCC property and will terminate in the bottom of Bingham Creek. If yellow brown soils are encountered in the trench, these soils will need to be placed back into the trench and covered with at least 18 inches of clean soil. The trench will need to be filled to at least the current adjacent land surface elevation

This letter authorizes South Jordan and TransJordan to access the Kennecott property at the location along Highway 111 discussed above and place the pipe as needed to prevent runoff erosion on Kennecott property.

Thank you for your cooperation in this matter. If you should have any questions, please contact me at 569-7128

Sincerely,

Jon Cherry, P E
Project Manager
Kennecott Utah Copper Corporation

Cc Eva Hoffman – EPA Region VIII
Dwayne Woolly—TransJordan Landfill

APPENDIX E
EXCERPTS FROM ARCO FINAL REPORT FOR BINGHAM CHANNEL CLEANUP

3.0 BINGHAM CREEK CHANNEL INSPECTION

The remediation activities completed in 1996 included construction of several flow structures along a specific reach of the Bingham Creek channel. Flow structures were constructed to provide elevation drops and dissipate energy to aid in control of channel erosion. The specific channel reach containing these structures extends from 2700 West Street in West Jordan to about 400 ft. west of Redwood Road. This reach is interrupted by a large new underground conduit running from about 2500 West to 2200 West Streets, carrying the flow under a densely populated area. Therefore, the Final Inspection of the Bingham Creek Channel conducted on April 2, 2002, included only the specific reaches from 2700 West Street to 2500 West, and from 2200 West Street to about 500 feet east of Redwood Road.

The focus of this inspection was observation and evaluation of the following items:

- Vegetation and aquatic growth development in the channel for soil stabilization.
- Erosion around the flow structures that could expose tailings that have been covered.
- Debris/trash barriers caught in the flow structures that could lead to bank erosion around the flow structures.
- Structural condition of the flow structures.

3.1 Vegetation and Aquatic Growth

Vegetation continues to flourish in the channel along most of Bingham Creek that was observed, as shown in the accompanying photographs in this section. Estimates of high water flow during spring runoff indicate a flow depth of about 3 feet. The flow structures have functioned as designed to help control flow velocity between structures and allow vegetation to develop a root matrix that will control channel erosion during normal flows. One exception is the area between Sugar Factory Road and Redwood Road where land owners have made duck/geese ponds at the flow structures and these fowl have completely denuded the channel and banks of any vegetation (see Photo 7).

3.2 Erosion Around Flow Structures

A major maintenance activity during the 5 year OMP period has been the repair of structures damaged by erosion of banks or channel bottom at the flow structures. This damage was usually caused by a build up of trash on the structure or from temporary structures inserted by local residents for duck ponds or swim areas.

The Salt Lake County Flood Control (SLCFC) has primary responsibility for Bingham Creek; coordinating between Kennecott, West Jordan City, and the Granger-Hunter Improvement District. West Jordan City has responsibility for channel improvements and repair within the city limits, which includes the specific reaches for OMP responsibility. These entities have recently directed storm water from large development areas into the Bingham Creek Channel upstream from the area of OMP responsibility. Law requires that a Stream Channel Alteration Permit be obtained and approved from/by (SLCFC) before any work can be performed in the channel or to channel structures. On June 30, 2000 AECI obtained a permit to perform OMP repairs and maintenance. This

permit approval was difficult to obtain, and instructions given with the approval was that since the design flow has been greatly increased for Bingham Creek Channel, they will not approve any more permits to work in the channel until the channel design has been upgraded to the present design flow. AECI was instructed to conduct future inspections by an observation walk through. If trash build-ups or temporary dams were observed, they should be reported and as manpower/budget became available they would correct the situation. Subsequent inspections including the Final Inspection have been conducted in compliance with these instructions. Photo 8 shows Structure No. 18 which is representative of this type of maintenance. No significant bank erosion was observed during the inspection.

3.3 Trash Barriers in Channel

No significant debris piles or trash were found that significantly impeded flow over any of the structures. It appears that the high flow this spring washed most trash through the structures and on to the Jordan River.

3.4 Condition of Flow Structures

The general structural condition of the flow control structures was excellent. The only qualification is Structure No. 17, which has a still pond undercut of the exit apron (see Photo 8). As can be seen in the photo, this is a very steep reach of the channel that is exacerbated by the private citizen constructed dam placed on the entrance apron of Structure No. 17, clearly seen in upper right of Photo 8. This dam was placed by the land owner to provide more water storage for his ducks and geese. The effect of this dam is to raise the water surface elevation over its crest about 18 inches adding a large amount of potential energy into the water, increasing flow velocity through Structure No. 17. At his time the undercut is only under the exit apron and is about 6 ft. from the end of the flow structure.

3.5 Photographs of Flow Control Structures

Photo 1 is representative of structures between 2700 West and the 4 ft X 10 ft underground conduit.

Photo 1, Structure No. 3

Photo 2 shows the newly constructed overflow structure on the irrigation canal that allows excess flow to spill over weirs into the underground conduit at 2200 West Street near the end of the conduit which is shown in Photo 3.

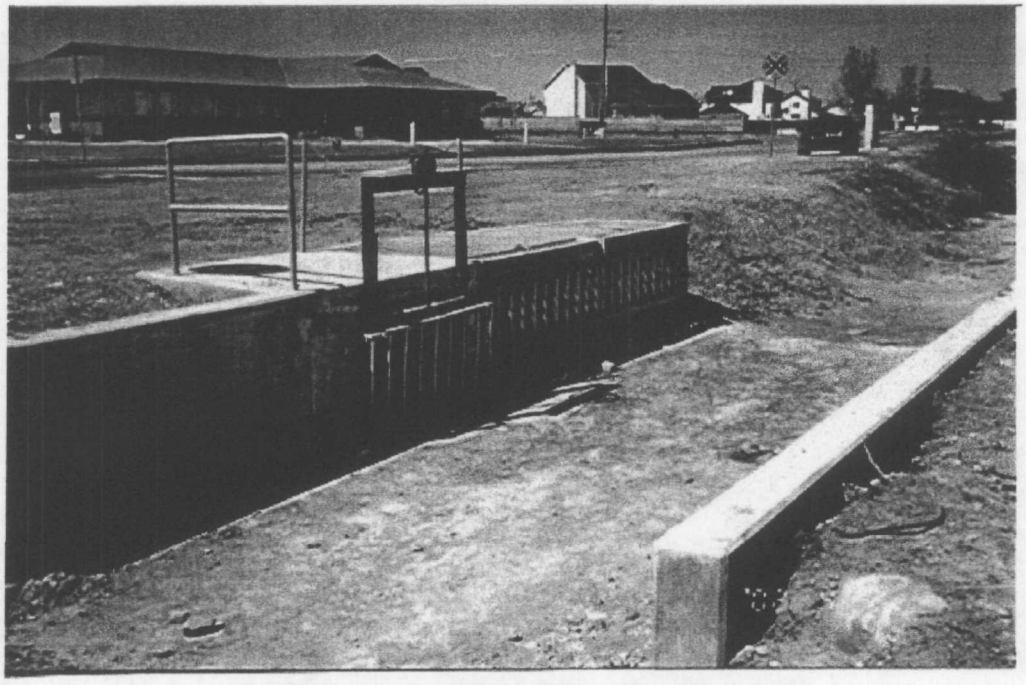


Photo 2, Canal Overflow Structure

Photo 3, Bingham Creek Conduit Outlet (2200 West)

Photos 4-6 are representative of the channel reach that runs along Sugar Factory Road from the conduit outlet at 2200 West St. to the bridge at about 2000 West.

Photo 4, Structure No. 10

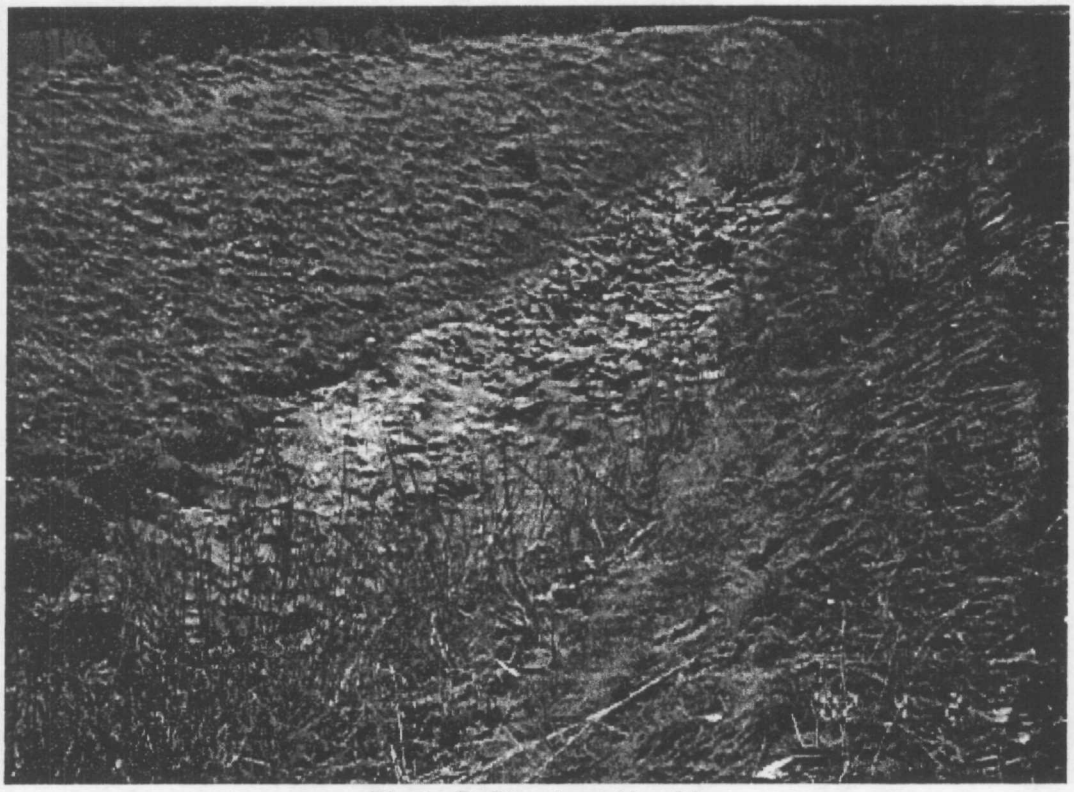


Photo 5, Structure No. 11

Photo 6, Structure No. 12

Photos 7-9 are representative of the channel from the Sugar Factory road bridge at 2000 West to the Redwood Road bridge.

Photo 7, Structure No. 16

Photo 8, Structure No. 17

Photo 9, Structure No. 18

APPENDIX F
EXCERPTS FROM KENNECOTT GROUND WATER PROTECTION PERMITS

Table 8.1-42: All Availiable BRG999 Data

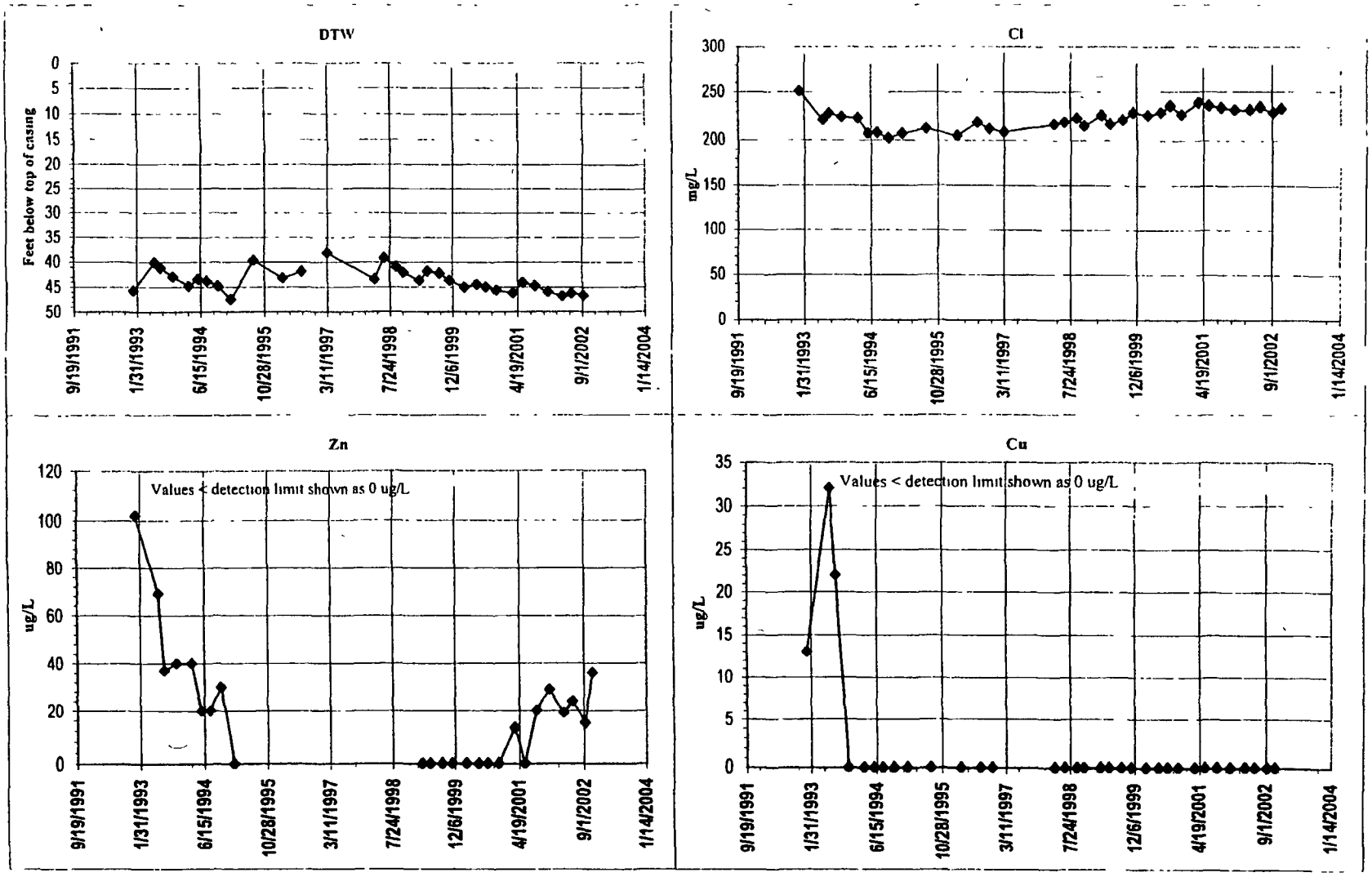
As, Cd, Cr, Cu, Pb, Se, Zn (dissolved concentrations) in ug/L, pH in std units, electrical conductance in umhos/cm, temperature in degrees C, all others in mg/L

<CRDL = concentration less than Contract Required Detection Limit Blank = not analyzed

Site_ID	BRG999	<-------Chose a site using this dropdown list Listed in alphabetical order All data and charts will update automatically

Results	Element																		
Sampled_date	DTW	pH	Cond	Temp	TDS	Alk	SO4	Cl	Ca	Mg	Na	K	As	Cd	Cr	Cu	Pb	Se	Zn
9/24/1993		7 3	1411	14	1080	202	332	172	158	62	25	3 2	3	<CRDL	3	2	<CRDL	2	24
10/20/1993	228 42	7 11	1652	12	1200	201	438	194	233	57	69	7 1	8	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
11/20/1993	229 42	6.95	1691	13	1210	206	447	203	236	57	59	7 1	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
12/22/1993	228 5	7 05	1747	13 5	1270	204	461	203	228	69	60	7 7	10	<CRDL	<CRDL	<CRDL	<CRDL	6	110
1/20/1994	229 74	7 01	1760	13		199	441	240	203	75	64	6 5	6	<CRDL	<CRDL	<CRDL	<CRDL	4	<CRDL
2/15/1994	229 84	7 02	1804	12 5	1270	203	445	214	247	64	62	7	5	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	10
3/28/1994	230 17	6 9	1760	13	1210	204	462	232	257	64	67	8 1	6	<CRDL	<CRDL	<CRDL	<CRDL	3	<CRDL
4/28/1994	230 35	7 08	1822	10	1290	205	452	225	219	69	71	7 1	5	<CRDL	<CRDL	<CRDL	<CRDL	4	40
5/24/1994	230 33	7 06	1923	15	1320	200	449	226	255	51	69	7 2	6	<CRDL	<CRDL	<CRDL	<CRDL	4	<CRDL
6/16/1994	231 42	7 18	1562	14 5	1300	197	448	217	254	62	76	7 5	6	<CRDL	<CRDL	<CRDL	<CRDL	4	20
7/18/1994	230 9	6 97	1840	15	1310	203	459	215	248	61	54	7	6	<CRDL	<CRDL	<CRDL	<CRDL	7	20
8/10/1994	231 2	6 83	1740	17	1390	201	454	219	232	74	68	7 9	6	<CRDL	<CRDL	<CRDL	<CRDL	4	20
9/14/1994	231 63	7 02	1680	14	1280	205	492	209	262	65	71	6 3	10	<CRDL	<CRDL	<CRDL	<CRDL	9	<CRDL
10/5/1994	231 84	6 96	1643	12 5	1472	200	498	221	273	69	60	7 9	8	<CRDL	<CRDL	<CRDL	<CRDL	5	10
1/12/1995	232 94	6 97	1825	11	1298	201	440	224	204	56	50	5	<CRDL	<CRDL	<CRDL	50	<CRDL	7	10
4/6/1995	233 1	6 97	1794	13	1200	200	424	221	249	71	65	6 5	<CRDL						
7/11/1995	230 86	6 9	1547	16	1270	198	425	209	251	56	54	6 5	6	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	20
10/3/1995	230 73	7 12	1802	14	1300	200	402	209	252	63	66	7	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
1/3/1996	232 13	6 84	1660	13	1330	213	469	239	287	71	68	6 8	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	4	<CRDL
4/8/1996	231 42	6 89	1656	14	1200	203	466	222	232	61	56	5 3	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
7/16/1996	230 1	7 08	1674	16 5	1400	209	517	217	265	69	68	7 1	7	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
10/21/1996	230 12	7 06	1748	12	1320	213	484	218	249	66	63	6 1	5	<CRDL	<CRDL	<CRDL	<CRDL	5	<CRDL
11/15/1996		7 02	1880	11 9	1360	210	706	228	268	68	67	6 6	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
1/28/1997	229 82	6 79	1839	11	1290	209	486	221	254	66	63	6 5	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
4/22/1997	228 75	7 29	1811	13	1250	207	445	213	268	67	66	7	7	<CRDL	<CRDL	<CRDL	<CRDL	4	<CRDL
7/8/1997	228 12	7 46	1807	16	1310	205	497	203	264	69	76	7 9	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	2	<CRDL
10/14/1997	228 41	6 78	1754	14	1250	216	448	222	248	62	61	6 3	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
1/6/1998	223 85	6 67	1829	12	1320	217	458	221	268	70	67	5 1	6	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
4/14/1998	222 85	6 82	1703	12	1370	242	457	186	260	62	66	6 9	7	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
7/16/1998	217 87	7 27	1655	15	1280	216	390	183	228	55	59	6 1	6	<CRDL	<CRDL	<CRDL	<CRDL	3	<CRDL
10/12/1998	216 32	7 01	1597	13	1090	211	401	195	242	61	61	4 6	5	<CRDL	<CRDL	<CRDL	<CRDL	2	<CRDL
1/5/1999	217 23	6 94	1649	12	1250	214	455	197	252	66	67	7 4	5	<CRDL	<CRDL	<CRDL	<CRDL	2	<CRDL
4/5/1999	218 53	6 6	1717	12	1210	217	498	195	240	62	68	6 6	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	3	<CRDL
7/8/1999	219 12	6 96	1566	15	1160	219	468	192	229	58	62	6 2	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	3	<CRDL
10/6/1999	219 63	6 9	1654	15	1150	216	499	203	245	62	63	6 5	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL

Figure 8.1-41 continued: ECG936 Time Series Graphs



Sampled_date	DTW	pH	Cond	Temp	TDS	Alk	SO4	Cl	Ca	Mg	Na	K	As	Cd	Cr	Cu	Pb	Se	Zn
1/4/2000	221 51	7 28	1702	12	1200	217	468	205	252	62	63	6 4	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	3	<CRDL
4/3/2000	223 07	6 83	1692	13	1270	209	450	208	251	63	67	6 1	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
7/5/2000	224 41	6 89	1757	15	1230	209	477	213	252	67	69	6 6	5	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
10/11/2000	225 92	6 86	1734	12	1270	208	489	209	255	67	64	6 8	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	2	<CRDL
1/9/2001	227 91	6 76	1715	13	1270	206	455	211	267	67	67	6 8	9	<CRDL	<CRDL	<CRDL	<CRDL	2	<CRDL
4/2/2001	228 9	6 83	1744	13	1170	205	448	210	241	59	58	5 9	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	2	<CRDL
7/5/2001	230 49	7	1814	16	1390	208	510	210	268	67	67	7 3	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
10/1/2001	231 74	6 77	1795	15	1410	201	499	198	273	68	67	7 6	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	13
1/3/2002	233 08	6 89	1645	12	1350	212	529	217	264	66	65	7	5	<CRDL	<CRDL	<CRDL	<CRDL	2	<CRDL
4/16/2002	234 42	6 94	1752	11	1400	209	538	214	265	67	66	6 8	8	<CRDL	<CRDL	<CRDL	<CRDL	2	11
7/1/2002	235 37	6 84	1871	16	1340	194	460	219	246	62	62	7 4	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
10/28/2002		6 97	1834	10	1319	200	512	216	289	74	76	9 4	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	11

Figure 8.1-42: BRG999 Time Series Graphs

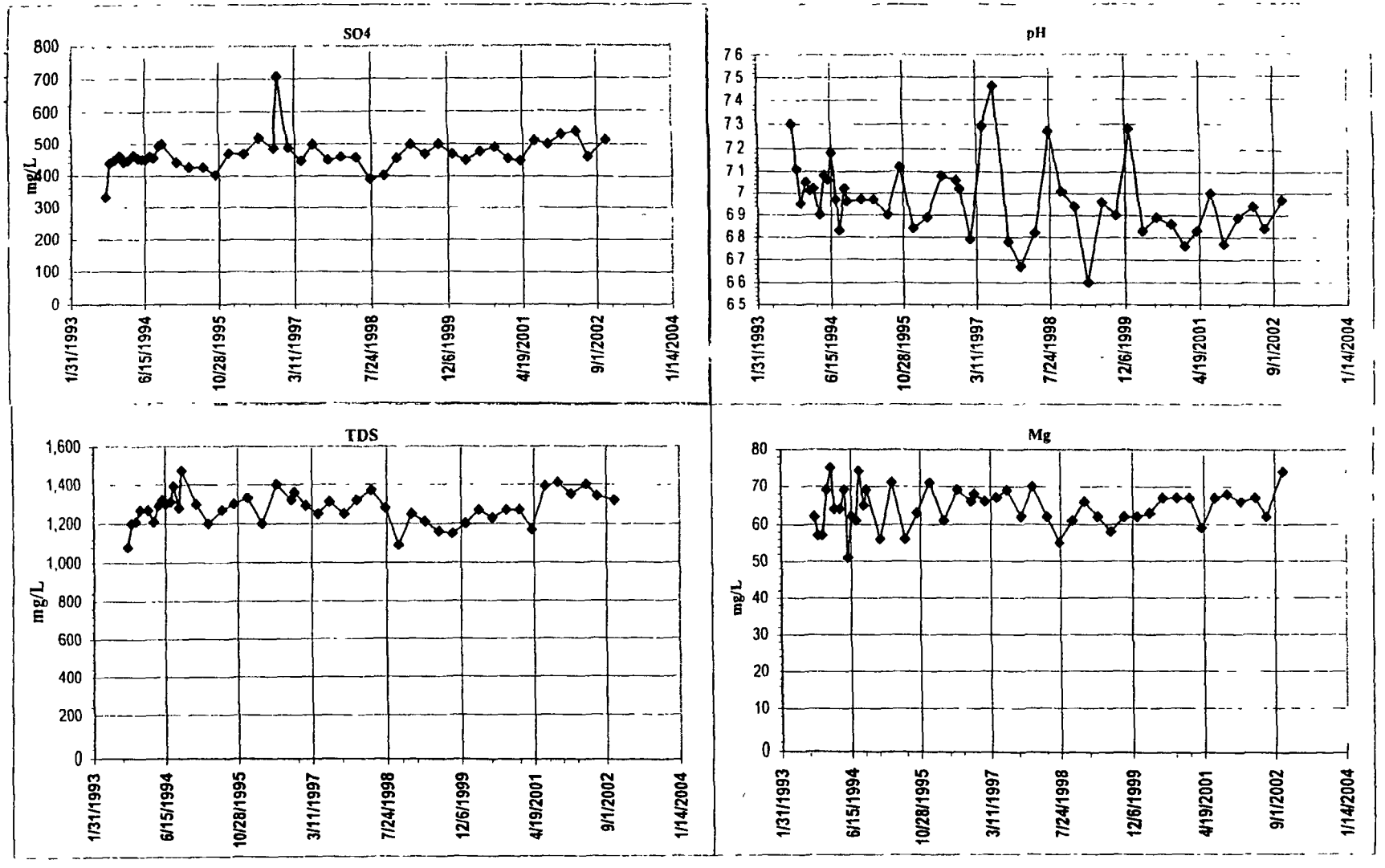


Figure 8.1-42 continued: BRG999 Time Series Graphs

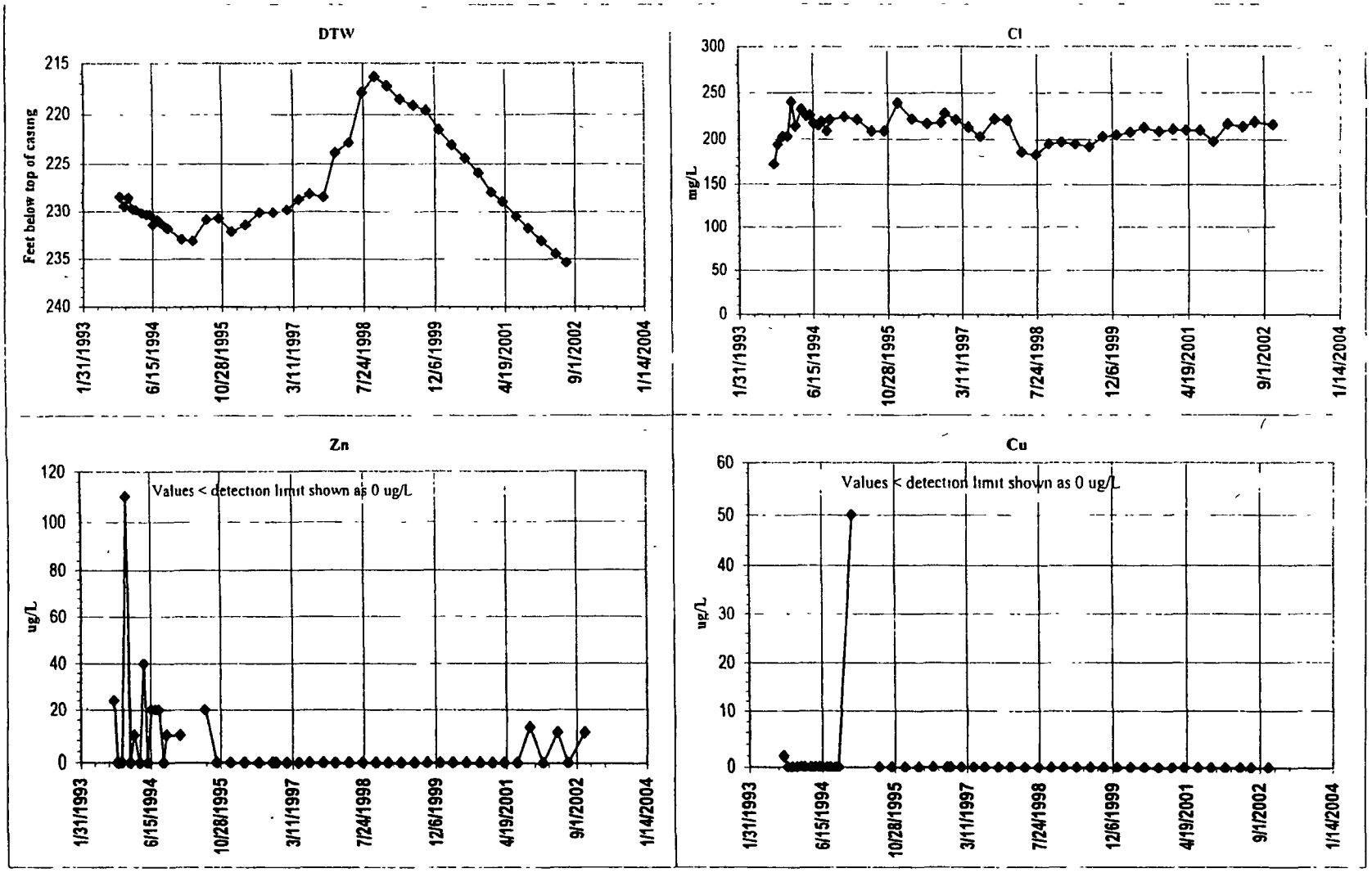


Figure 8.5-1: Average Flow into the Bluewater 1 North Repository Sump, BRP292

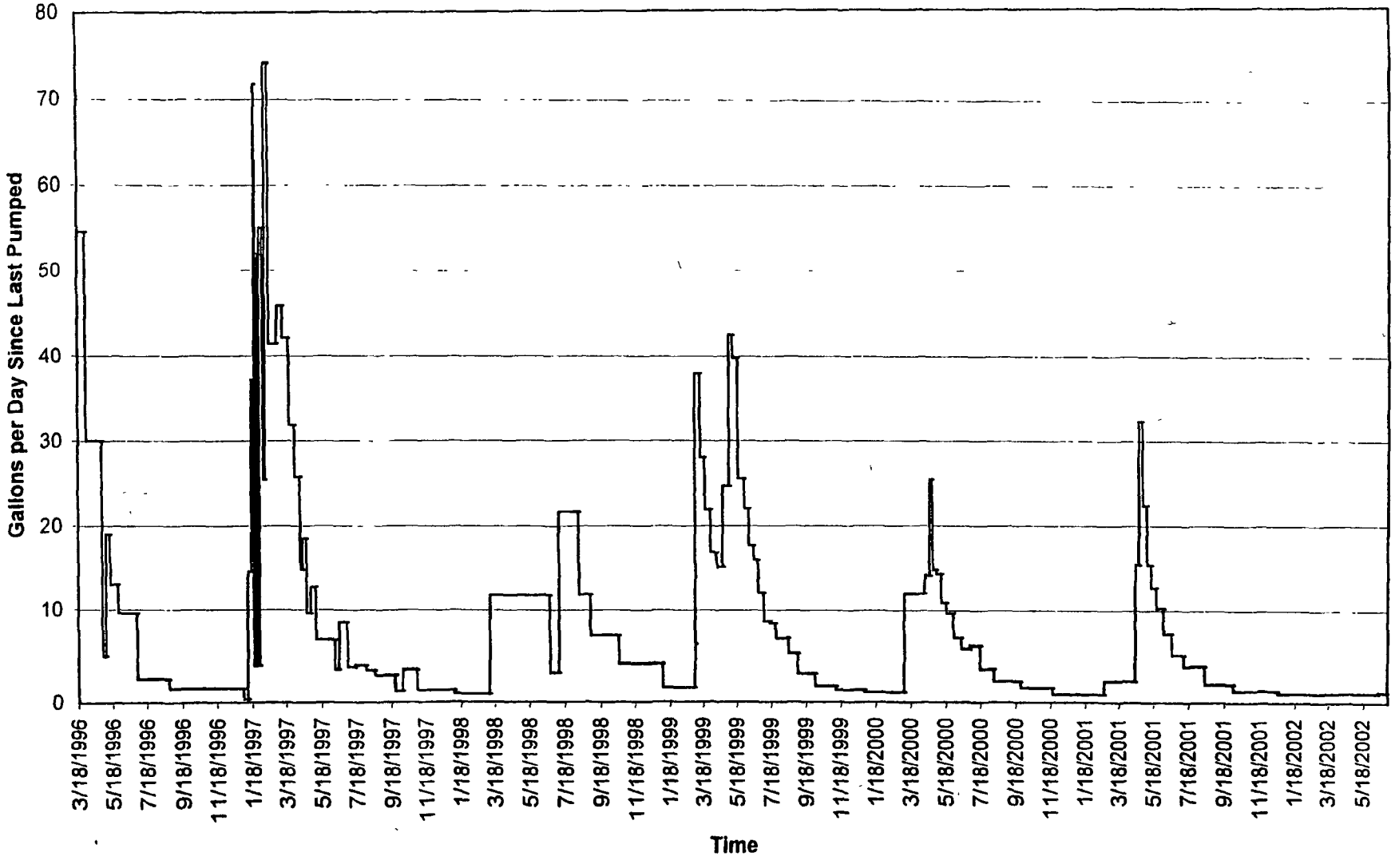


Table 8.5-1: Flow into the Bluewater 1 North Repository Sump, BRP292

Date	Quarter	Volume Pumped (Gallons)	Days (since last pumped)	Average Flow into Sump (GPD)	Cumulative gallons/Quarter Total	per day
3/20/2002	1	99.4	92	1 08	97.75	1 08
6/13/2002	2	96 0	96	1 13	104 87	1 00
8/28/2002	3	95 2	76	1.25	112 03	1.25
12/2/2002	4	111 3	96	1 16	104 69	1 16
				Grand total 2002=	419 34	

GPD = Gallons per Day

Table 8 5-2 Summary Statistics for Sump Sites

As, Cd, Cr, Cu, Pb, Se, Zn (dissolved concentrations) in ug/L, pH in standard units, electrical conductivity in umhos/cm, temperature in degrees C, all others in mg/L
Summary statistics were calculated using detection level values where concentration was below the detection limit This method produces a conservatively high statistic
na = not available

Site ID	Data	pH	Cond	Temp	TDS	Alk	SO4	Ca	Cl	Mg	K	Na	As	Cd	Cr	Cu	Pb	Se	Zn
BRP1476	Ave Conc	7 20	4131	12	4372	257	2774	516	161	427	11	199	7	84	15	6031	7	4	16685
	# Samples	19	19	18	19	19	19	19	19	19	19	19	21	21	21	21	21	13	21
	Max Conc	8 08	6300	24 5	6200	443	3690	684	662	662	21 4	580	16	737	26	68000	50	23	150000
	Min Conc	5 80	2230	3	2160	107	1310	326	35	164	4 4	74	5	1	10	0 03	5	2	0 07
	Std Dev	0 62	1139 3	7 3	1257 7	97 5	749 1	86 0	138 3	164 7	5 0	120 1	2 9	222 0	7 4	18709 2	9 8	5 8	43748 8
BRP292	Ave Conc	6 25	5595	10	6006	279	3696	575	359	530	6	434	14	608	20	20449	17	15	72550
	# Samples	30	30	30	31	30	31	31	31	31	31	31	33	33	33	33	33	22	33
	Max Conc	7 62	9150	18	12800	476	9300	752	698	1533	13	627	57	4700	50	209000	50	30	189000
	Min Conc	5 10	2990	2	3300	49	2030	434	65	170	4 3	88	5	1	10	1 8	1	2	9
	Std Dev	0 51	1004 3	4 4	1435 5	117 2	1124 4	65 5	162 1	208 5	2 0	113 1	10 6	1069 8	11 7	50924 0	19 4	9 3	55155 8

Table 8 5-3 2002 Sampling Results and Summary Statistics for Sump Sites

As, Cd, Cr, Pb, Se, Zn (Dissolved Concentrations) un ug/L, pH in standard units, electrical conductivity in umhos/cm, temperature in degrees C, all others in mg/L
For samples where parameters were < detection, a value of one half the detection limit was assumed for summary statistics
Summary statistics were not calculated for sites with two samples or less
na = not analyzed

Site ID	Date	pH	Cond	Temp	TDS	Alk	SO4	Ca	Cl	K	Mg	Na	As	Cd	Cr	Cu	Pb	Se	Zn
BRP1476	3/26/2002	7 54	2740	9	2830	180	1920	421	53	8 5	250	88	<20	<10	20	0 03	<50	<2	0 07
BRP292	3/26/2002	6 07	5440	6	5640	292	3500	567	267	7 2	556	386	<20	223	20	1 9	<50	17	62 5
	4/4/2002	6 27	5540	8	5840	250	3640	543	258	5 8	506	364	<20	205	20	1 9	<50	30	50
	9/19/2002	6 54	5310	16	5780	470	3800	637	234	8 5	600	404	21	300	20	2 9	<50	30	72 2
	12/13/2002	6 42	5160	10	5770	358	3750	640	234	8 9	626	420	23	240	20	1 8	<50	3	79
	Mean	6 33	5363	10	5758	343	3673	597	248	7 6	572	394	16	242	20	2	<50	20	65 9
	Max Conc	6 54	5540	16	5840	470	3800	640	267	8 9	626	420	23	300	20	3	<50	30	79 0
	Min Conc	6 07	5160	6	5640	250	3500	543	234	5 8	506	364	<20	205	20	2	<50	3	50 0
	Std Dev	0 20	165	4	84	96	133	49	17	1 4	53	24	7	41	0	1	na	13	12 6

Figure 8.5-4: BRP292 Time Series Graphs

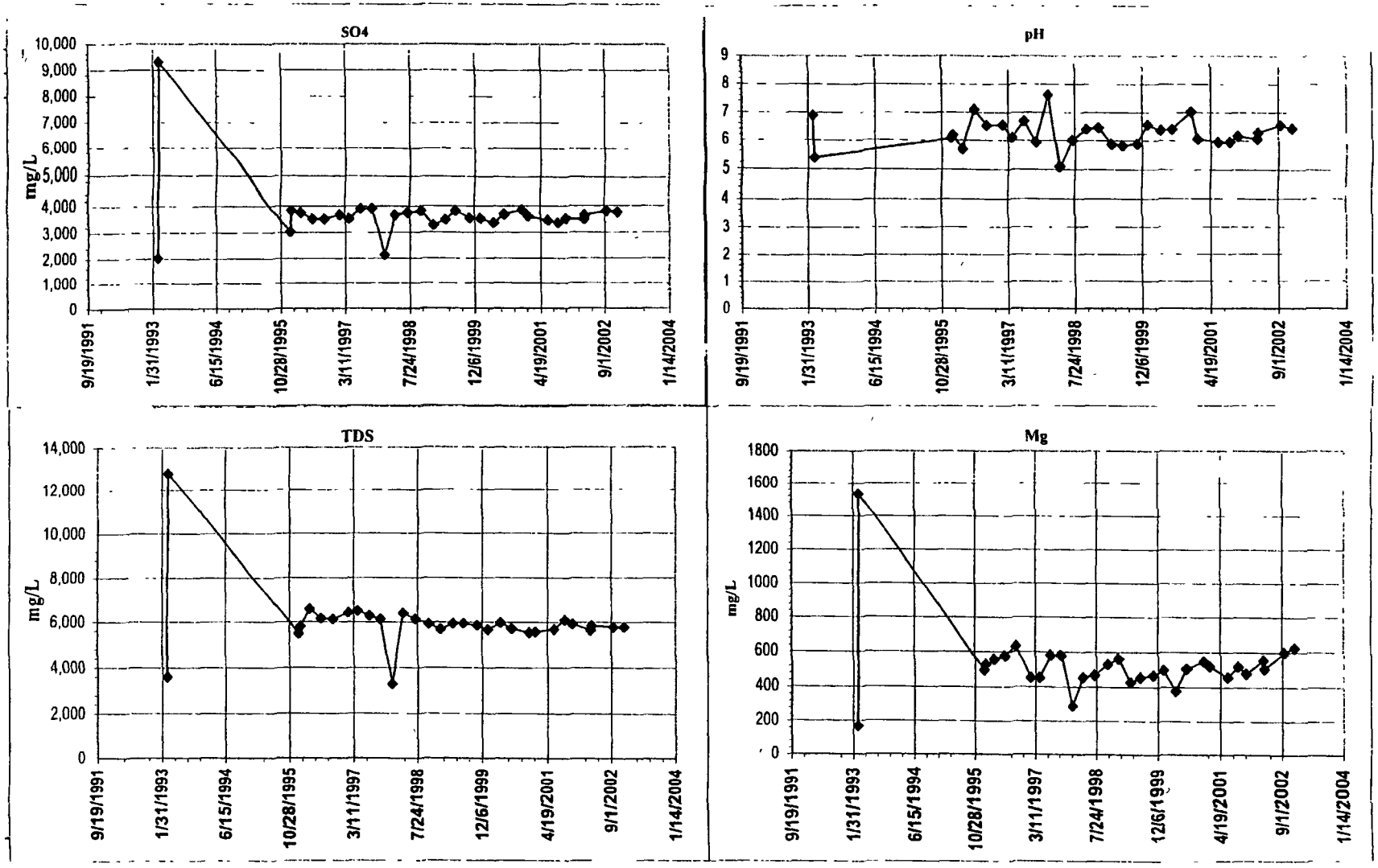


Table 8.5-4: All Availiable Bluewater 1 N. Repository Sump Data

As Cd. Cr, Cu, Pb, Se Zn (dissolved concentrations) in ug/L, pH in std units, electrical conductance in umhos/cm temperature in degrees C. all others in mg/L

<CRDL = concentration less than Contract Required Detection Limit Blank = not analyzed

Site_ID | BRP292 <-------Chose a site using this dropdown list Listed in alphabetical order All data and charts will update automatically

Results	Element																		
Sampled_date	DTW	pH	Cond	Temp	TDS	Alk	SO4	Cl	Ca	Mg	Na	K	As	Cd	Cr	Cu	Pb	Se	Zn
3/10/1993		6 9	2990	4	3600	476	2030	65	752	170	88	12	7	<CRDL	14	2	<CRDL	4	9
3/19/1993		5.38	9150	13	12800		9300	123	719	1533	590	13	20	4600	50	208000	10	120	10000
1/9/1996		6 07	4660	4	5480	383	3020	241	502	496	341	4 8	11	154	<CRDL	4010	<CRDL	38	115000
1/22/1996		6 18	4980	3 5	5800	336	3830	229	537	529	331	5 3	<CRDL	49	<CRDL	630	<CRDL	10	63800
4/2/1996		5 69	5770	10	6590	60	3750	483	645	557	522	5 9	<CRDL	260	<CRDL	24100	<CRDL	37	189000
7/1/1996		7 11	5770	15	6160	194	3520	370	562	577	432	5 7	13	190	<CRDL	1590	<CRDL	46	78600
10/2/1996		6 53	5270	15	6120	431	3520	271	646	633	433	7 7	<CRDL	244	<CRDL	1770	<CRDL	45	70700
1/30/1997		6 55	5230	5	6420	49	3670	698	572	453	548	6 1	10	1030	<CRDL	27000	<CRDL	34	154000
4/11/1997		6 09	6000	7	6490	79	3530	661	516	454	477	4 7	<CRDL	620	<CRDL	6500	<CRDL	<CRDL	131000
7/11/1997		6 68	5760	12	6280	291	3900	475	604	582	474	6 6	<CRDL	404	<CRDL	5750	<CRDL	9	76300
10/6/1997		5 94	5740	17 5	6140	350	3910	350	612	580	421	6 8	<CRDL	239	<CRDL	3000	<CRDL	13	92600
1/7/1998		7 62	3270	2	3300	137	2140	65	434	288	130	5 5	9	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	10
4/2/1998		5 1	5930	5	6400	143	3660	633	602	455	627	4 8	<CRDL	887	<CRDL	82000	<CRDL	5	139000
7/8/1998		6	5330	12	6150	149	3750	595	627	469	546	8 8	6	770	<CRDL	31500	<CRDL	7	146000
10/21/1998		6 39	6000	13	5910	340	3810	211	576	531	455	5 2	18	390	<CRDL	5030	<CRDL	17	100000
1/19/1999		6 46	5320	8	5670	270	3280	328	580	564	426	7 6	<CRDL	260	<CRDL	2700	<CRDL	28	71300
4/23/1999		5 87	5490	7	5930	214	3490	501	558	428	547	4 6	6	640	<CRDL	12091	<CRDL	17	119544
7/13/1999		5 83	6420	12 5	5940	242	3820	494	534	455	532	4 8	<CRDL	680	<CRDL	19800	<CRDL	11	143000
10/28/1999		5 89	5520	15	5850	337	3550	385	537	470	430	5 2	12	380	<CRDL	4420	<CRDL	<CRDL	100000
1/19/2000		6 56	5630	8	5660	307	3540	316	536	499	386	5 1	6	315	<CRDL	1900	<CRDL	23	69000
4/26/2000		6 36	6210	8	5970	180	3370	488	477	377	504	4 3	11	400	<CRDL	3920	<CRDL	5	88800
7/19/2000		6 39	6250	14 5	5710	262	3680	452	542	506	510	5 3	18	298	<CRDL	2880	<CRDL	16	90200
12/1/2000		7 03	5680	10	5530	285	3850	313	573	550	497	6 6	11	282	<CRDL	1332	<CRDL	30	54197
1/16/2001		6 07	5730	8	5570	355	3620	294	582	522	406	5 8	24	270	27	2412	<CRDL	51	65400
6/14/2001		5 96	6050	13	5680	328	3460	442	546	459	388	6 4	57	396	21	7600	<CRDL	10	108000
9/5/2001		5 96	6100	18	6100	470	3370	354	564	521	461	6 3	27	369	23	4700	<CRDL	17	106000
11/7/2001		6 16	5450	15	5910	321	3530	307	506	480	386	5 8	24	260	24	2200	<CRDL	19	77800
3/26/2002		6 07	5440		5640	292	3500	267	567	556	386	7 2	<CRDL	223	<CRDL	1900	<CRDL	17	62500
4/4/2002		6 27	5540		5840	250	3640	258	543	506	364	5 8	<CRDL	205	<CRDL	1090	<CRDL	30	50000
9/19/2002		6 54	5310		5780	470	3800	234	637	600	404	8 5	21	300	<CRDL	2900	<CRDL	30	72200
12/13/2002		6 42	5160	10	5770	358	3750	234	640	626	420	8 9	23	240	<CRDL	1800	<CRDL	3	79000

Figure 8.5-4 continued: BRP292 Time Series Graphs

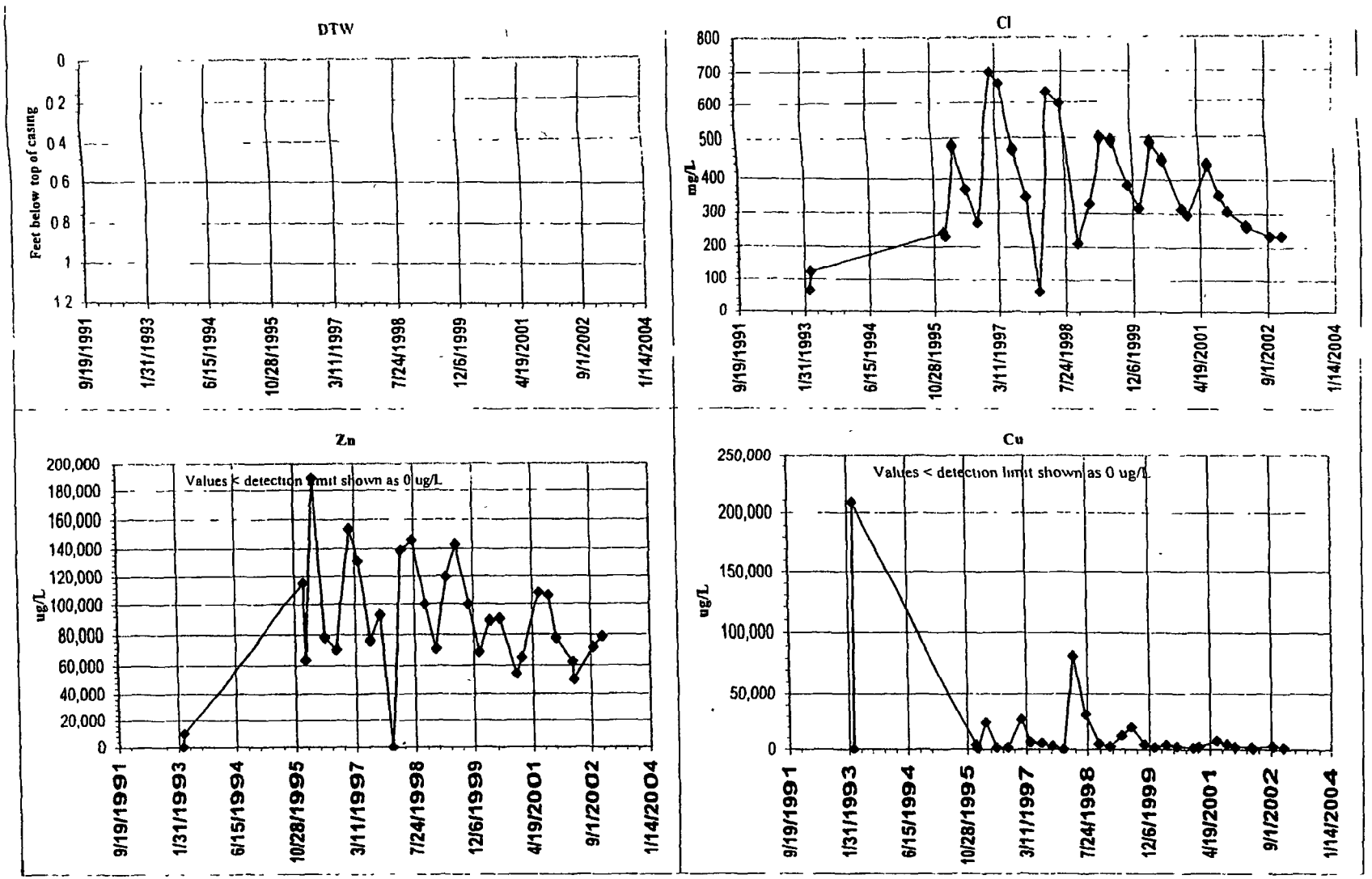


Table 8.5-5: All Availiable Bluewater 1 Main Repository Sump Data

As, Cd, Cr, Cu, Pb, Se, Zn (dissolved concentrations) in ug/L, pH in std units, electrical conductance in umhos/cm, temperature in degrees C, all others in mg/L
<CRDL = concentration less than Contract Required Detection Limit Blank = not analyzed

Site_ID	BRP1476	<-------Chose a site using this dropdown list Listed in alphabetical order All data and charts will update automatically

Results	Element																	
Sampled_date	DTW	pH	Cond	Temp	TDS	Alk	SO4	Cl	Ca	Mg	Na	K	As	Cd	Cr	Cu	Pb	Se	Zn
6/7/1996		7 81	4600	15	5540	387	3100	170	585	535	250	7 5	6	<CRDL	<CRDL	20	<CRDL	18	<CRDL
7/19/1996		7 6	4650	24 5	5400	443	3260	167	563	662	198	19 1	9	<CRDL	<CRDL	30	<CRDL	8	10
10/2/1996		7 86	4960	15	5470	304	3270	178	555	635	230	16 3	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	13	10
1/30/1997		6 66	2230	3	2620	107	1810	35	398	191	91	8 5	<CRDL	3	<CRDL	80	<CRDL	4	320
4/24/1997		7 7	3660	8	3560	203	2040	87	454	324	125	9 9	6	<CRDL	<CRDL	20	<CRDL	10	20
7/11/1997		7 19	4550	21	5490	380	3240	154	563	589	191	14 1	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
10/6/1997		6 6	4920	18	5200	273	3690	171	573	627	234	21 4	<CRDL	<CRDL	<CRDL	31	<CRDL	<CRDL	20
1/7/1998		6 36	5900	8	6200	313	3630	302	571	563	396	5 1	9	267	<CRDL	2140	<CRDL	23	70600
3/10/1998		5 8	6300		5560	168	3580	662	582	412	580	6 6	6	720	<CRDL	56000	<CRDL	26	129000
4/2/1998		6 44	2720	5	2860	186	1960	44	481	220	92	10 8	<CRDL	2	<CRDL	31	<CRDL	5	96
8/13/1998		7 35	4430	22	5260	284	3350	181	588	512	200	15 2	16	<CRDL	<CRDL	27	<CRDL	<CRDL	40
10/19/1998		8 08	4470	8	4750	331	3130	174	555	499	195	14 3	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL
1/19/1999		7 63	3370	4	3410	222	2100	108	437	323	157	8 4	6	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	17
4/21/1999		6 55	3820	9	4090	274	2980	109	524	420	152	10 2	9	1	<CRDL	37	<CRDL	<CRDL	89
7/12/1999		7 34	5360	24	5580	344	3630	199	684	591	203	16 9	<CRDL	<CRDL	<CRDL	23	<CRDL	<CRDL	<CRDL
12/28/1999		7 68	3800	3	3780	122	2480	129	498	328	218	4 4	<CRDL	<CRDL	<CRDL	39	<CRDL	<CRDL	38
1/19/2000		7 34	2390	6	2160	113	1310	63	326	164	74	5 5	<CRDL	1	<CRDL	30	<CRDL	<CRDL	14
4/26/2000		7 35	3620	13	3310	243	2230	72	437	274	100	8 4	12	1	<CRDL	50	<CRDL	<CRDL	62
3/26/2002		7 54	2740		2830	180	1920	53	421	250	88	8 5	<CRDL	<CRDL	<CRDL	30	<CRDL	<CRDL	70

Figure 8.5-5: BRP1476 Time Series Graphs

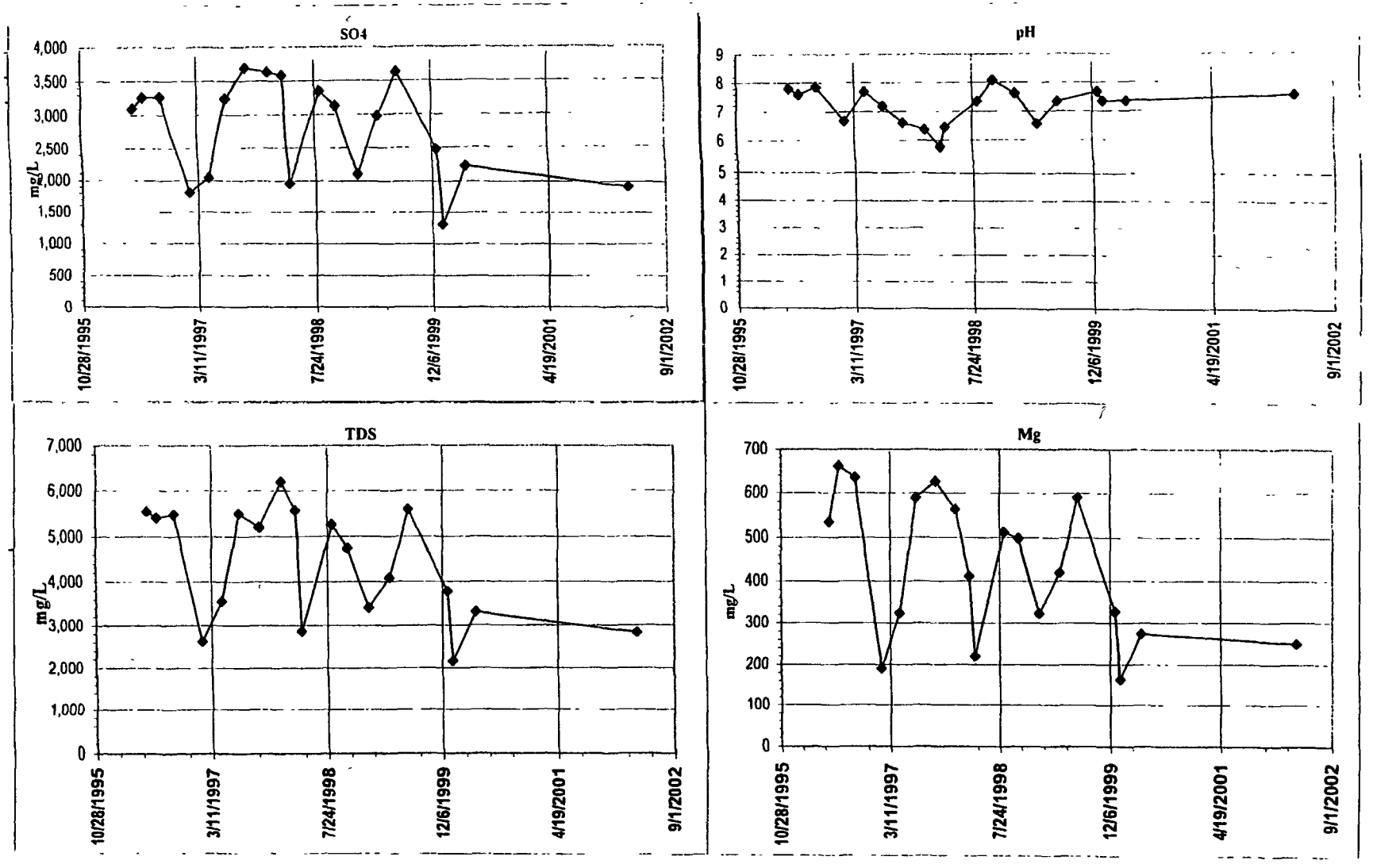
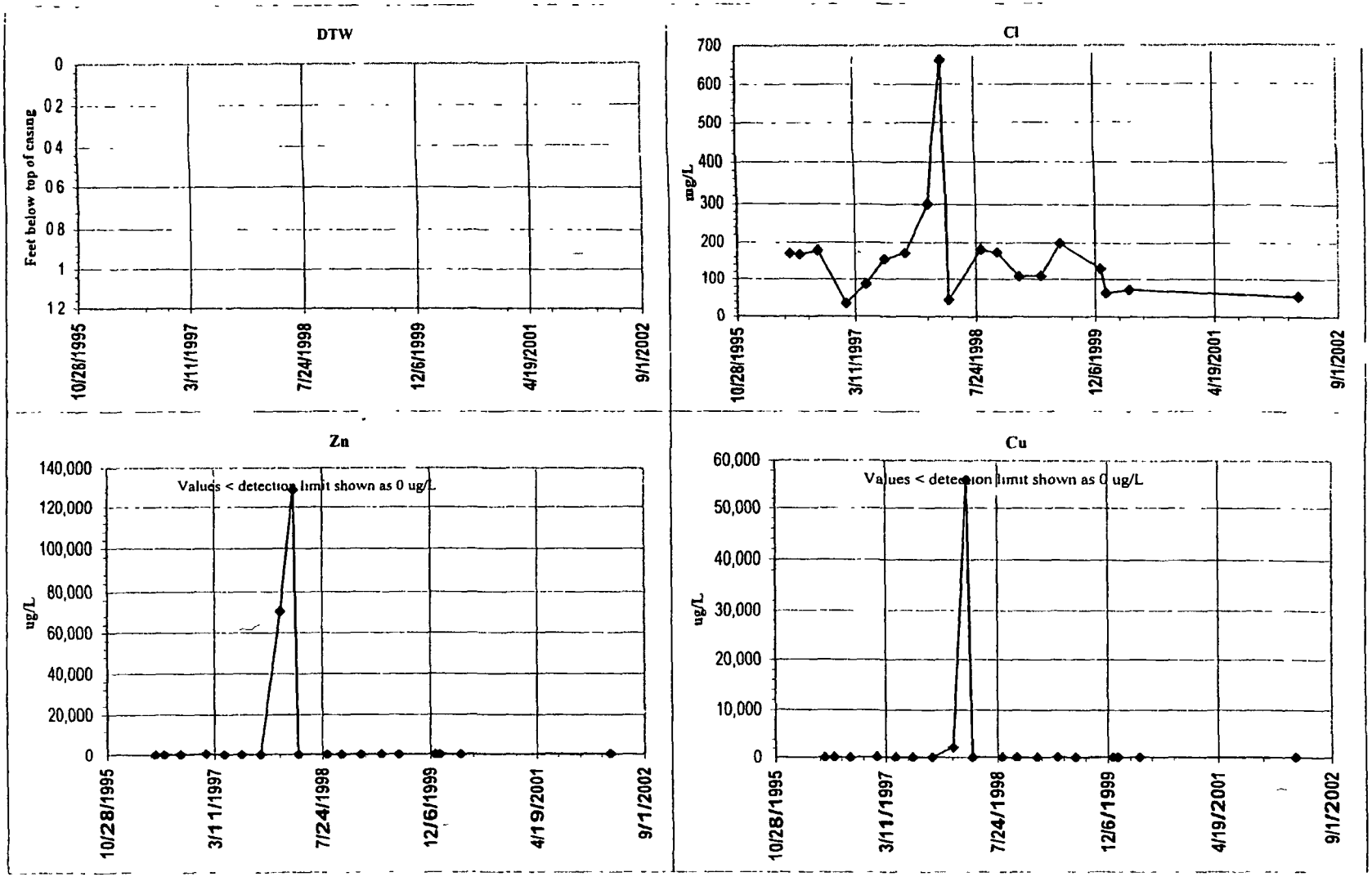


Figure 8.5-5 continued: BRP1476 Time Series Graphs



KENNECOTT UTAH COPPER CORP.
STRATEGIC RESOURCES GROUP
P O BOX 112
10200 S 8400 W
BINGHAM CANYON, UT 84006-0112
FAX: (801)569-6854

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TO: Eva	FROM Brian
COMPANY:	DATE: 6/19/03
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RE	TOTAL NO. OF PAGES INCLUDING COVER

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NOTES/COMMENTS:

Eva,

The water which reports into the BW 1 North Repository may come from the bedrock interface or from infiltration. Because the flows are higher in Spring, much of the flow may be infiltration of shallow or perched into the repository.

1999. As expected, flows were highest in the spring (second quarter) and dropped off toward year's end in five of the seven tunnels In the Mascotte and 5490 Tunnels the flows were mostly constant throughout the year. Dry Fork Tunnel flow decreased from 2436 gpm in the second quarter 1999 to 38 gpm in the fourth quarter 1999 due to cessation of active leaching on the Dry Fork waste rock dumps in mid-July 1999. Decreasing flow from other tunnels is likely a function of seasonal hydrological cycles but may be a response to changing leaching conditions.

Summary statistics of water quality data from the tunnels for the period of record and for 1999 are given in Tables 8.3-2 and 8.3-3 respectively. In 1999, the poorest water quality was measured in the Dry Fork Tunnel (ECP2689) where low-pH (mean 2.87) and high-TDS water is captured. Since leaching on the Dry Fork waste rock piles was stopped in July 1999, water quality has been improving (Table/Figure 8.3-8); in the second quarter the discharge had concentrations of 98,100 mg/L TDS and 71,000 mg/L SO_4, but in the fourth quarter those concentrations had decreased to 45,600 and 32,900 mg/L, respectively.

The other six tunnels all discharged water in 1999 with TDS concentrations between 758 and 4420 mg/L. No obvious trends were apparent in aqueous chemistry of the other tunnels.

4.4 Surface Seeps

Four perennial seeps were identified in the latter part of the second quarter and added to the sampling schedule as semi-annual sites. Flow measurements from the four surface seeps ranged from 0.3 to 5 gpm and are tabulated in Table 8.3-1. Flow from each seep decreased more than 50 percent from spring to winter.

Summary statistics of water quality data are given in Table 8.4-1. Tables and graphs of individual seeps are provided in Tables/Figures 8.4-3 through 8.4-6 With only two samples, data trends are not meaningful. It is worth noting that at Upper Keystone Seep (ECS2716) the average chloride concentration, 809 mg/L, is higher than typical leach water or well water. In this area of the valley there is chloride-rich groundwater from volcanic bedrock that is likely contributing a portion of this seep's flow. Sulfate concentration is also relatively high at about 5900 mg/L, so a mixture of mining-related and native chloride-rich water is probably discharging at this site.

4.5 Bluewater Repository Leachate-Collection Sumps

Sump site BRP292 collects water that enters the french drain system underlying the Bluewater 1 North Repository. This site is pumped dry when needed to maintain the level of water in the sump below the inlet pipe from the drain system. The total volume pumped from this site in 1999 was 4602 gallons (Table 8.5-1). Daily flow into the sump, calculated by averaging the volume evacuated over the period of time between pumping events, ranged from 1.4 to 42.5 gallons per day. From Figure 8.5-1 it is apparent that flow into the sump is greatest during the spring months and decreases to almost no flow in the fall and winter. Summary statistics for the quarterly water samples taken from this sump are compiled in Table 8.5-2 and 8.5-3 and data for each sample date are given in Table/Figure

8.5-4. For the last four years the water quality has remained relatively stable with near neutral pH and TDS around 6000 mg/L.

Sump site BRP1476 collects water that enters a french drain system underlying the Bluewater 1 Main Repository. Water that enters this sump drains by gravity into the leach collection system. Flow is estimated to be about two gallons per day with higher flow in the spring and early summer. Summary statistics for the quarterly water samples taken from this sump are compiled in Table 8 5-2 and 8.5-3 and data for each sample date are given in Table/Figure 8.5-5. There is a cyclical pattern in concentrations in this water; TDS concentrations, for example, fluctuate from about 3000 mg/L in the spring and summer to 5000 to 6000 mg/L in the late summer through late winter. This may be due to dilution of pore water by infiltration of spring snowmelt and precipitation through the repository (it is still open to receive soils).

4.6 Other Wells

Well ECG1184 has been sampled on a monthly or quarterly basis and is reported in this report even though it is not classified in the permit as an operational or compliance well. The composite water quality in the alluvium at the mouth of Butterfield Canyon, as measured by ECG1184, is included for comparison to water quality in the bedrock of individual basins draining areas of waste rock dumps on the north side of Butterfield Canyon. When the TDS concentrations from the six compliance monitoring wells in Butterfield Canyon (ECG932, ECG934, ECG935, ECG937, ECG938, ECG940) are averaged, the result is very close to the concentration of ECG1184, or about 1280 mg/L. The same is true for the sulfate concentrations, which average about 590 mg/L. Data are provided in Table/Figure 8.6-3

Well ECG1185, the Copperton Channel Extraction Well, has been sampled on a semi-annual basis and is reported in this report even though it is not classified in the permit as an operational or compliance well because it is part of the collection system. The well pumps about 30 gpm (Table 8.2-1) of poor-quality groundwater (pH = 4, TDS = about 4000 mg/L) from a small buried alluvial channel near the town of Copperton (Table/Figure 8.6-4).

5.0 QUALITY ASSURANCE/QUALITY CONTROL

Data quality objectives and quality assurance/quality control (QAQC) procedures and standards for this permit are those defined in the GCMP and Quality Assurance Project Plan for the GCMP (KUC 1998a, 1998c). Kennecott Environmental Laboratory (KEL) maintains its own quality control program which is in accordance with the GCMP program. Laboratory quality control for all samples collected for this permit is maintained by KEL and is reported in depth in the quarterly QA reports for the GCMP (KUC 1999a, 1999b, 2000) and summarized in this report. Field quality control for all monitoring well samples collected for this permit is maintained by the KUC Water Sampling Group and is also reported in depth in the quarterly QA reports for the GCMP and summarized in this report. Field quality control for all non-well operational sampling for this permit is

for the non-well sites are included in this report in Appendix A Discussion of monitoring results is presented in section 4 0 Quality assurance and quality control review of these data are discussed in section 5 0 and Certificates of Analysis for the quality control samples are provided in Appendix A Compliance monitoring results are submitted to the DWQ in quarterly reports and are not included or discussed in this report

KUC occasionally collects samples at permit sites more frequently than required by the permit and these samples may not have been collected using GCMP protocol or analyzed using methods specified in the permit These data may be included in the tables and charts to provide the most complete history of water quality at any site, but all the permit-required analytes may not have been analyzed and quality control may not be as stringent as for the permit samples Certificates of Analysis are only included for the permit samples

Operational monitoring wells are sampled once per quarter or once per year, depending on the well and its proximity to the leach collection system. Sampling of non-well sites occurs twice per year in the spring and fall or quarterly for tunnel and repository sump sites

2.1 Isotope study

Appendix B is the September 1999 status report received by KUC from researchers at the University of Utah Department of Geology and Geophysics This report provides an update on the age dating and source identification study of leach water-related contamination (see Permit Part I, Section K, Item 7) The interim report provides a summary and preliminary conclusions of the isotopic sampling and analysis. One conclusion was that there is an increase in the recharge year with depth (measured from 1962 to 1995 using CFCs) along the entire East Side collection system Hydrogen isotopes were measured in 16 wells to determine if the contaminants in those wells are from active leach water or from meteoric leach water Most wells had hydrogen isotope ratios indicative of a meteoric leach water origin or a mixture of meteoric and active leach water. Waters will also be dated using tritium/helium isotopes Flow modeling was in its early stages

3.0 BLUEWATER REPOSITORY ACTIVITIES

A total of 264 cubic yards of waste soil was placed in the Bluewater 1 Main Repository in 1999 The soils came from four sources soil characterizations in and around the town of Herriman, removal of contaminated floodplain sediments in Butterfield Canyon, soil investigations in the Salt Lake Valley, and removal of contaminated soil by land developers in Bingham Creek. There were no organic contaminants present in any of the soils. One sample (sample identification number HR-20) was analyzed for total metals and Synthetic Precipitation Leaching Procedure (SPLP) The soils were all topsoil-type material originating in floodplain environments, and therefore were less heterogeneous than waste that was previously deposited in the Bluewater 1 Repositories. Based on this relative homogeneity, the number of samples was adjusted downward as allowed by

Appendix B of the permit from the general guidelines given in that appendix Certificates of these analyses are provided in Appendix A Metal contaminant concentrations of concern were lead = 1670 mg/L, arsenic = 26 8 mg/L, and chromium = 11 6 mg/L, which are relatively low for waste soils The sample passed SPLP

Quality and volume of water that collects in the two sumps that underlie the Bluewater 1 North and Bluewater 1 Main Repositories are discussed in section 4 5

4.0 OPERATIONAL MONITORING RESULTS DISCUSSION

The following sections discuss the results of operational monitoring To simplify reading of the text and graphical materials simultaneously, the large number of graphs and tables referred to in these sections are presented in a separate section, section 8 0 As required in Appendix E of the permit, summary statistics, including number of samples, maximum, minimum, and mean concentrations, and the standard deviation of concentration, are calculated for each site These statistics were calculated twice, once for all data through the period of record, and again for the 1999 data because many sites have such a long history that averages and standard deviations calculated on all the data are not useful in understanding current conditions Also required in Appendix E of the permit is an evaluation of all data through time of the significant trend-indicating parameters (sulfate, pH, total dissolved solids, magnesium, chloride, dissolved zinc, dissolved copper, and depth to water for wells) for any obvious trends This analysis is presented in the following sections tables and charts are included in section 8 0

4.1 Groundwater Monitoring Wells

Forty groundwater monitoring wells are designated in the permit as operational monitoring wells. Each of these is sampled quarterly or annually Many of them have a sampling history dating back more than a decade Summary statistics were calculated for each well and provided in Tables 8 1-1 and 8.1-2. Notable trends in the time-series data are discussed here on a drainage basin basis starting on the north end of the collection system and continuing south

Most of the operational monitoring wells installed in the early 1990s show any dissolved metal concentrations that were detectable (usually in the tens of µg/L) decreasing to below detection limit values in the first one or two years of sampling. This may be the case in some wells even if other major constituents are increasing It is possible that groundwater mixing or other events associated with drilling introduced low levels of dissolved metals into the waters and therefore true groundwater conditions were not represented by the early samples Also, in the early 1990s the standard operating procedures for water sampling were just being developed so differences in sampling may account for some of these concentrations

Bingham Creek – General water quality in both wells P248A and P248B (Tables/Figures 8 1-11 and 8 1-12) has been improving since installation of Bingham Creek cut-off wall in 1995, especially P248A in which TDS and sulfate concentrations decreased to 1/3 of their

1994 value. Water level also decreased by about 10-15 feet over this time, suggesting a change in flow regime in this area

Bluewater ½ – Well BRG919 sulfate concentration is on a gradual increase, since 1992 the concentration has risen from about 125 mg/L to 275 mg/L (Table/Figure 8 1-33) In the past three years there have been three instances of pH dipping below 7 25 and rising again, The lower pH occurrences were in October 1996, January 1997 and January 1998

Bluewater 1 North Repository – Other than a steady upward trend in sulfate and magnesium in well BRG287 (Table/Figure 8 1-15), most other indicator parameters in surrounding wells are stable All the wells surrounding the repository, BRG286 BRG287, BRG288, BRG289, BRG290, BRG291A, and BRG999 (Tables/Figures 8 1-14 through 8.1-19 and 8 1-42), show zinc gradually decreasing to below detection limit values. There have been several recent hits on copper in BRG287 Water levels have fallen by 10-15 feet in three of the wells (BRG287, BRG288, BRG289) since installation of the repository, but have recovered by about half in the past two years The change in water levels may be more closely related to activities associated with construction and pumping at the Bingham Creek cut-off wall than with the repository

Bluewater 1 Main Repository – BRG920, BRG921, and BRG999 (Tables/Figures 8 1-34 and 8 1-35 and 8.1-42) have shown slight depression of pH. Water levels in BRG921 and BRG999 rose about 15 feet in 1998

Bluewater 1 – There are four wells downgradient of the leach collection pipeline. Sulfate concentration and water level have risen recently in all. Wells ECG299 and K72 (Tables/Figures 8.1-20 and 8 1-3) show a marked increase in sulfate concentration starting in 1995 The other major constituents such as TDS and magnesium increased as well. In ECG299, chloride concentration decreased proportionally to sulfate increase, suggesting a displacement of native groundwater, which is higher in chloride, by mining-affected groundwater Starting in 1997, sulfate concentrations in well ECG901 and to a lesser extent ECG900 (Table/Figure 8 1-22 and Table/Figure 8 1-21) have begun to increases Also starting in 1997, water level elevations in all four wells have risen by 15-20 feet. One possible source of the increased sulfate is from the construction of the Bluewater 1 Main and Bluewater 1 North Repositories and/or installation of the new Bluewater 1 cut-off wall in 1992-1993 During these construction projects, soils that had been affected by impoundment of leach water behind the old Bluewater 1 cut-off wall were repositioned, exposing new surfaces to infiltrating precipitation The infiltrating water may have dissolved contaminants that were on the soil particles and moved into the groundwater system Increasing water level may be due to increased recharge from spring run-off water that has backed up in the drainage above these wells in recent years

Bluewater 2 – The well nearest the waste rock dumps in Bluewater 2 drainage is ECG909 The time-series charts for all the major indicators in this well (Figure 8 1-30) show a deterioration of water quality in 1998 Copper and zinc increased from less than 100 mg/L to 3000-4000 mg/L Because of its close proximity to the waste rock dumps, this well may be one of the first to see changes induced by leaching activities in the dumps The two

wells located farther down the drainage. ECG902 and P225, did not show any notable trends, except a slight downward trend in pH (Table/Figure 8 1-23)

Bluewater 3 – There are four wells located in Bluewater 3 drainage, two of which have gradually increasing concentration trends In 1997, P220 (Table/Figure 8 1-4) sulfate concentration rose to roughly 1200 mg/L, up from 72 mg/L in 1980, but has since decreased to 748 mg/L TDS has doubled in the same period Dissolved metal concentrations are mostly below detection but occasional hits have been detected ECG904 (Table/Figure 8 1-25) has had deteriorating water quality since its installation in 1992, except copper and zinc concentrations, which were high after installation and have since been below detection Of the other two wells in the drainage, ECG903 (Table/Figure 8 1-24) has some data variability but no continuous upward trend and ECG905 concentrations are stable (Table/Figure 8 1-26)

Midas – Water quality and water table elevation in the two wells in upper Midas drainage, ECG908 and ECG916 (Tables/Figures 8 1-29 and 8 1-32) have been stable in the last few years The high concentrations measured in the first several sampling events on ECG908 are probably an artifact of drilling, it is possible that poor-quality surface water was transmitted to groundwater via an open borehole during drilling ECG906 (Table/Figure 8 1-27) is located below the confluence of Midas and Congor drainages Depth to water has risen eight feet since 1994 while sulfate, TDS and magnesium have increased and pH and chloride have decreased slightly When sulfate, a mining-related contaminant, increases and chloride, which is concentrated in connate waters in the volcanic rocks in this area, decreases, a flow regime change may be taking place in which mining-impacted water may be moving into the vicinity and displacing native chloride-rich water

Congor – ECG915 (Table/Figure 8 1-31) has shown a slight decrease in pH with increased variability. The most recent sample had a dissolved copper concentration of 26 mg/L, the first above detection value since 1994

Crapo – ECG907, located in the bottom of Crapo drainage, and ECG922 located just over the crest of the north ridge of Crapo drainage, have good correlation between trends. In both wells there is a slight but steady upward trend in sulfate, magnesium and water level (Tables/Figures 8.1-28 and 8 1-36) The trends correlate very well, with even the small highs and lows in sulfate, TDS, and pH coinciding within about six months of each other. Absolute values of concentration are also similar, except chloride is about 150 mg/L higher in ECG907

North Keystone area – ECG923 and ECG928 are located southeast of North Keystone drainage basin in a broad relatively flat area The water table has risen 30 feet in both wells (Tables/Figures 8 1-37 and 8 1-39) This may be part of long term variability associated with precipitation variations, or the increase in this area in particular may be due to increased hydrostatic pressure induced by increased volume of leach water in the waste rock dumps in 1998 (see Section 4 2) Sulfate and TDS in these two wells show gradual increases in concentration

Keystone – P272 has shown steady improvement in water quality since 1990 and declines in water level since March 1998 (Table/Figure 8 1-13)

Lark area – ECG926 data are relatively stable

North Copper – An interesting relationship between sulfate and chloride concentrations exists in wells P244A, P244B and P244C In P244A (Table/Figure 8 1-8), an inverse relationship between decreasing sulfate and increasing chloride is apparent beginning in 1995 This relationship is thought to represent a flow regime change in which mining-impacted water is replaced by an increase in the proportion of native chloride-rich water entering the well screen (in this well sulfate and chloride concentrations are currently around 6000 and 1300 mg/L, respectively) This inverse relationship does not hold true in P244B or, to a lesser extent, in P244C (Tables/Figures 8.1-9 and 8 1-10) In these wells both sulfate and chloride concentrations increased in the late 1980s and early 1990s Chloride concentration has since stabilized but sulfate continues to climb slowly. One hypothesis is that instead of a flow regime change in which native chloride-rich groundwater replaces mining-impacted water, as indicated by chloride increase contemporaneous with sulfate decrease, the flow regime has not changed, but rather the chloride-rich native water is perhaps passing through a source of contamination where it picks up sulfate but also retains the chloride All three wells were modified in 1998 to accommodate the new mine access road; depth to water measurement on the tables and figures are adjusted for this change

Copper – P239 (Table/Figure 8 1-7) has seen a slight improvement of water quality

ECG931, located in an unnamed drainage between Copper and Yosemite, has sulfate concentrations of close to 600 mg/L, and they have been increasing for the last three years from around 400 mg/L (Table/Figure 8 1-40)

Yosemite – P228 water quality deteriorated significantly in the 1980s with sulfate increasing five-fold, but it has been stable at TDS of 8000-10000 mg/L for the past decade (Table/Figure 8 1-6)

Castro – Water quality in the bedrock in Castro drainage as measured by well ECG936 has been stable (sulfate of 2500-3000 mg/L) for the life of the well (Table/Figure 8 1-41).

4.2 Leach and Meteoric-leach Operational Monitoring

Samples from leach collection sites before May 1999 were not likely to be collected using GCMP protocol, so these data sets may be less complete with less quality control checks performed, nevertheless, they are included here to provide whatever background is available at these sites

No semi-annual samples were collected for the first half of 1999 ("spring" sampling event) from Bluewater ½ Collection Box (ECP2682), North Keystone Flume (ECP2648), and Queen Cut-off Wall (ECP2601) because they were dry at the time of sampling (see Table 8 2-1, Collection System Monthly Flow Measurements) North Keystone and Queen were

also dry at the "autumn" semi-annual sampling event A sample was collected in the spring at South Saints Rest Cut-off Wall (ECP2612) even though no flow was recorded After reviewing the analytical results, it is apparent that the sample was rain water that had ponded in the collection box, which explains why no flow was recorded

Monthly flow measurements for each leach collection measurement site are presented in Table 8 2-1 Flow is also measured at the Upper Lined Canal, where no leach water should be flowing, and the Lower Canal, which represents cumulative flow from the southern waste rock dumps and pumping from Lark Shaft

In 1999, KUC began the process of leach cessation on the East and West Side waste rock dumps. Prior to this time, 10,000 to 28,000 gpm of active leach water were being sprinkled on the waste rock dumps In March 1998, the leaching operations were even expanded farther south to the dumps above Keystone and Copper drainages, increasing return flows to those collection sites. Then on January 29, 1999 most of the expanded leaching was terminated Further East Side leaching reduction continued on June 23 when leaching on Code 45, located on top of the dumps above Keystone was stopped On July 15 the leaching of the West Side (Dry Fork) dumps was terminated, and on August 25 leach water application on Code 40, above Congor and Keystone, was stopped In October and November the volume of leach water being applied to the dumps above Midas and Bluewater 2 drainages (O level, L main level, and Code 51 areas) was reduced to between 4500 and 6500 gpm As expected, the flow at several of the collection sites down-gradient from actively leached portions of the dumps decreased dramatically due to these steps as documented in Table 8 2-1 Returning leach water flow at Midas 1 Flume decreased from 6859 to 3784 gpm, at Congor 1 and 2 Flume it decreased from 6257 to 657 gpm, and Keystone Flume it decrease from 3327 to 529 gpm This is in addition to flow reduction before measurement for this permit began in May

Seasonal decrease in flow is evident at Castro Flume meteoric-leach collection site (see Table 8 2-1)

Summary statistics for water-quality data collected at the leach collection sites is given in Tables 8.2-2 and 8 2-3 Generally, the collection sites that collect active leach water (those from Bluewater 1 to Keystone) have much more concentrated leach water than the sites where meteoric leach water is collected Active leach sites generally have TDS concentrations of approximately 90,000 – 110,000 mg/L, sulfate of 65,000 – 80,000 mg/L and copper of 100 – 600 mg/L (100,000 – 600,000 µg/L) There are several collection sites in the "active leach" system that are not capturing active leach water, as determined by their better quality water and lower flow These include North Copper, Lost Creek, Crapo, and South Conger 1 and 2 It is thought that the water reporting to these sites is a mixture of meteoric leach water and bedrock recharge, possibly with some active leach water. Concentrations at these sites range from around 3000 to 45,000 mg/L TDS The South waste rock dumps, which have seen only meteoric leaching for decades, have highly variable water quality and much lower flow TDS concentrations are always less than 25,000 mg/L and generally range form 2000 – 6000 mg/L Copper and zinc are less than 150 mg/L (150,000 µg/L)

The time-series charts are not as useful for leach collection site data as for well data because of the limited number of samples at most sites There is greater variability in the leach collection sites than at wells because of variations in flow, the proportions of different waters in the leach water mixture and surface conditions such as precipitation events Most of the sites do not show any obvious data trends Those that do are discussed below

Bingham Creek Cut-off Wall (ECP2562) water quality worsened and then improved in 1997 – 1998 (Table/Figure 8 2-4) At this large cut-off wall, the water that intersects the cut off wall is pumped out at about 300 gpm (Table 8 2-1) rather than draining by gravity as at the other cut-off walls.

Castro Flume (ECP2606), a meteoric-leach collection site, shows a large variability over the four-year sampling history, with TDS ranging from 9350 mg/L to 23,100 mg/L A seasonal variability is suggested by these data with a net upward trend (Table/Figure 8 2-8).

Yosemite Cut-off Wall (ECP2616) showed an improvement in water quality in the March 25, 1998 sample event (Table/Figure 8 2-11)

Copper Flume (ECP2618) water quality began to worsen in mid-1998 with sulfate and magnesium concentrations increasing and pH decreasing (Table/Figure 8 2-12) This is because active leaching was expanded farther south onto the Keystone dump in March 1998, above this collection site Interestingly, copper concentration decreased at the same time from roughly 550 mg/L to 145 mg/L, indicating that the mostly meteoric flow that had been percolating through the dump was higher in copper than the pregnant leach water This trend began to reverse itself a few months after leaching was stopped in January 1999

North Copper Flume (ECP2624) has shown direct response to leach cessation activities. From the first samples collected in 1996 until late 1998 the concentrations were relatively stable, but when leaching in the waste rock dumps above this collection site was stopped, the TDS, sulfate and magnesium concentrations decreased to about one fourth of the previous concentrations (Table/Figure 8 2-13) Copper concentration decreased even more, from 300-400 mg/L to 50 mg/L At the same time, chloride concentration doubled, indicating a possible replacement of some of the leach water with chloride-rich groundwater

Most indicator parameters at sample site ECP2629, Keystone Flume, have been stable for the period of record except copper, which has decreased from approximately 180 mg/L to 85 mg/L (Table/Figure 8 2-15)

4.3 Tunnels

Seven tunnels are monitored on a quarterly basis for flow and water quality Flow measurements from each tunnel per quarter are tabulated in Table 8 3-1 Flow ranged from five gpm from Mascotte Tunnel to 2436 gpm in Dry Fork Tunnel in the second quarter of

APPENDIX G
RESULTS OF CHEMICAL ANALYSES, BINGHAM CREEK OU1

RESULTS OF CHEMICAL ANALYSES
BINGHAM CREEK OU 1

FIVE YEAR REVIEW

On the basis of discussions between EPA, UDEQ, ARCO, Kennecott, and the City of West Jordan, a list of sampling locations was developed for the purposes of determining if and where conditions along the developed portions of Bingham Creek might have changed. The concern was that, in the course of construction of public works projects and new construction of buildings, the capping materials used to bury the mining wastes in the original remedy might have been disturbed leading to unacceptably high concentrations of lead and arsenic being exposed at the surface.

Phase I of the sampling occurred on May 12 and 13, 2003. Based on these results, Phase II of the sampling occurred on May 27, 2003. Samples were collected by Mr. Ronald Segura of the U. S. Bureau of Reclamation, Provo Office, in accordance with the previously approved Sampling and Analysis Plan used at the site during the initial characterization. The samples were analyzed using X-Ray Fluorescence at the U. S. Bureau of Reclamation, Provo Office, by Linda Calton. In accordance with the sampling and quality assurance plans, 10% of the samples analyzed by XRF were sent to American West Laboratories, Salt Lake City, for confirmation analysis using method 6010B. All QC information (blanks, spike recovery, etc) were within acceptable limits. Chain of custody documentation was in order.

A summary of the sampling results is given in Table 1.

TABLE 1
SAMPLING RESULTS FOR BINGHAM CREEK DEVELOPMENTS

LOCATION (and BOR Sample ID)	Lead (mg/Kg) XRF	Lead (mg/Kg) 6010B	Arsenic (mg/Kg) XRF	Arsenic (mg/Kg) 6010B
Sugar Creek Condominiums - NE corner along fence at Bingham Creek bank in storm drain area - Surface Sample 0-2" (BC03-01)	555		ND	
Sugar Creek Condominiums - NW corner along fence at Bingham Creek bank in play area under tree - Surface sample 0-2" (BC03-02)	471	480	31	23
Salt Lake County Youth Justice Center at center line of storm water line - Surface sample 0-2" (BC03-03)	35		ND	

LOCATION (and BOR Sample ID)	Lead (mg/Kg) XRF	Lead (mg/Kg) 6010B	Arsenic (mg/Kg) XRF	Arsenic (mg/Kg) 6010B
Salt Lake County Youth Justice Center at 20 feet north of the storm water line center - Surface sample 0-2" (BC03-04)	278		ND	
Vista Montana Apartments, NE corner, next to RV storage area along center line of culvert - Surface sample 0-2" (BC03-05)	29		ND	
Vista Montana Apartments, NW corner, next to chain link fence along center line of culvert - Surface sample 0-2" (BC03-06)	357		ND	
2429 Sugar Factory Rd (new duplex) - 15 ft offset from the back fence at the bank of the creek - Surface sample 0-2" (BC03-07)	38		ND	
2449 Sugar Factory Rd (new duplex) - 15 ft offset from the back fence at the bank of the creek - Surface sample 0-2" (BC03-08)	42		ND	
2700 W Outlet of Box Culvert - Center Line of culvert at headwall (BC03-09)	2970	3000	144	130
2700 W Inlet of Box Culvert -Center Line of culvert behind the sidewalk (BC03-10)	175		22	
2700 W Outlet of Box Culvert - Center Line 15 feet from edge of asphalt (halfway between headwall and asphalt) (BC03-31)	337		36	
2700 W Outlet of Box Culvert -5 feet south of SE corner of the headwall - fill material between street and fence (BC03-32)	372		35	

LOCATION (and BOR Sample ID)	Lead (mg/Kg) XRF	Lead (mg/Kg) 6010B	Arsenic (mg/Kg) XRF	Arsenic (mg/Kg) 6010B
2700 W Outlet of Box Culvert - 15 feet NW from end of the north wing wall along top of creek bank (BC03-33)	748		47	
2700 W Outlet of Box Culvert - 25 feet downstream from end of the north wing wall along the top of the north bank (BC03-34)	159		ND	
2700 W Outlet of Box Culvert - 25 feet downstream from end of the north wing wall along the toe of the riprap on the north bank (BC03-35)	33		42	
2700 W Outlet of Box Culvert - 25 feet downstream from end of north wing wall, mid bank on the south bank of creek (BC03-36)	414		ND	
Cascade Springs Apartments - center line of the channel at the box culvert outlet (BC03-11)	496		36	
Cascade Springs Apartments - mid bank at the outlet of the culvert (BC03-12)	292		ND	
Cascade Springs Apartments - top bank at the outlet of the culvert (BC03-13)	268		39	
Cascade Springs Apartments - center line at the west end of the bridge (BC03-14)	309		ND	
Cascade Springs Apartments - mid bank at the west end of the bridge (BC03-15)	281		34	
Cascade Springs Apartments - top bank at the west end of the bridge (BC03-16)	198		33	
Cascade Springs Apartments center line at east end of the bridge (BC03-17)	218		ND	
Cascade Springs Apartments - mid bank at east end of the bridge (BC03-18)	490		ND	

LOCATION (and BOR Sample ID)	Lead (mg/Kg) XRF	Lead (mg/Kg) 6010B	Arsenic (mg/Kg) XRF	Arsenic (mg/Kg) 6010B
Cascade Springs Apartments - top bank at east end of the bridge (BC03-19)	125		ND	
Cascade Springs Apartments - center line halfway between bridge and end of ditch (BC03-20)	271		ND	
Cascade Springs Apartments - mid bank halfway between bridge and end of ditch (BC03-21)	183		ND	
Cascade Springs Apartments - top bank halfway between bridge and end of ditch (BC03-22)	493		ND	
Cascade Springs Apartments - centerline at the east end of the ditch and property (BC03-23)	913	960	ND	40
Cascade Springs Apartments - mid bank at east end of the ditch and property (BC03-24)	468		53	
Cascade Springs Apartments - top of bank in line with the sewer at the east end of the property (BC03-25)	624		ND	
Cascade Springs Apartments - middle of the lawn at apartment 2872 W (front south side) (BC03-26)	579		ND	
Cascade Springs Apartments - middle of the lawn at apartment 2758 W (front south side)(BC03-27)	254		ND	
The Woods at Creekview Subdivision, 8827 S Pagoda Tree Ln, edge of lawn next to channel (BC03-28)	558		ND	
The Woods at Creekview Subdivision 3348 W Olive Tree Circle, along south bank of creek (BC03-29)	389		36	

LOCATION (and BOR Sample ID)	Lead (mg/Kg) XRF	Lead (mg/Kg) 6010B	Arsenic (mg/Kg) XRF	Arsenic (mg/Kg) 6010B
The Woods at Creekview Subdivision 3358 W Olive Tree Circle, along south bank of creek (BC03-30)	533		ND	

APPENDIX H
KENNECOTT INSPECTION CHECKLISTS FOR BINGHAM RESERVOIRS

DESILTING BASIN
WEEKLY INSPECTION FORM

INSPECTION ITEM	YES	NO
Sludge De-Watering Occurring		X
Non-Meteoric Water Present 6" Above Chamber 1 Curbing		X
HDPE Liners and Concrete Sideslopes Intact	X	
Liners Attached to Curbing	X	
Curbing Intact	X	
Concrete Base Intact	X	
Water Sampling Necessary		X
Additional Chamber 1 Liner Continuity Test Required		X
Comments.		

INSPECTORS SIGNATURE. Edward Bourke

DATE. 10-6-02

BAT COMPLIANCE
WEEKLY INSPECTION
LARGE BINGHAM RESERVOIR - ZONE 1

INSPECTION ITEM	YES	NO	SUMPS 201	202	203	204	205	COMMENTS
Are there any debris or foreign objects in the reservoir		/						
PVC caps are in place and tight	✓							
Panel indicators operational	✓							
Water in sumps are below 4 0 foot level	✓							
Reservoir water level	5285.35							
Sump water level reading in ft			1.5	-1	0.9	1.7	1.2	
Addition for sensor height above sump bottom			1.5	1.5	1.5	1 5	1.5	
Actual sump water level in ft			3.0		2.4	3.2	2.7	

COMMENTS 202 Pump Pulled For Repair C.B.

INSPECTORS SIGNATURE: Chad Bowden

DATE: 10-6-02

BAT COMPLIANCE
WEEKLY INSPECTION
LARGE BINGHAM RESERVOIR - ZONE 1

INSPECTION ITEM	YES	NO	SUMPS 201	202	203	204	205	COMMENTS
Are here any debris foreign objects in the reservoir		✓						
PV caps are in place and tight	✓							Foul Weather Rain +
Pa l indicators oper onal	✓							Snow. Will Pump cell
Water in sums are b ow 4 0 foot level		✓						as Soon as Weather
Reservoir water level	52843							Break's.
Sump water level rea g in ft			1.8	0.1	0.9	2.0	2.6	
Addition for sensor hei t above sump bottom			1.5	1.5	1 5	1.5	1 5	
Actual sump water le l in ft			3.3	1.6	2.4	3.5	4.1	

COMMENTS

INSPECTORS SIGNATURE: Carl Bowler

DATE: 11-10-02

BAT COMPLIANCE
WEEKLY INSPECTION
LARGE BINGHAM RESERVOIR - ZONE 2

INSPECTION ITEM	YES	NO	SUMPS 208	209	210	211	212	COMMENTS
Are there any debris or foreign objects in the reservoir		✓						
PVC caps are in place and tight	✓							
Panel indicators operational	✓							
Water in sumps are below 4 0 foot level	✓							
Reservoir water level	5261.69							
Sump water level reading in ft.			0.9	0.8	2.1	1.9	2.9	

COMMENTS:

INSPECTORS SIGNATURE: Ethel Bond

DATE: 10-13-02

LARGE RESERVOIR - SUMP PUMP FIELD LOG

ZONE. 1

SUMP 205

DATE 11-11-02

PUMP DATA

Speed Drive Setting (Hz)	349
Sump water level at beginning	2.8
Sump water level at end	0.9
Time pump test is initiated	~~15~~ 14:15:21
Time at end of pump test	17:15
Bginning gallons (if using Flowmeter)	40.02
Ending gallons (if using Flowmeter)	40.52

RESULTS

Gallons pumped	50
Pumping Time	1 hr 54 min
Pumping rate	0.44
Head decrease	1.9
Leak>3 47 gpm?	NO
Signature	Chad Bowles

LARGE RESERVOIR - SUMP PUMP FIELD LOG

ZONE 1

SUMP 205

DATE 10-6-02

PUMP DATA

Speed Drive Setting (Hz)	349
Sump water level at beginning	4.0
Sump water level at end	0.9
Time pump test is initiated	10:08
Time at end of pump test	13:37
Bginning gallons (if using Flowmeter)	3881
Ending gallons (if using Flowmeter)	3967

RESULTS

Gallons pumped.	[redacted] 86
Pumping Time	3 hrs 19 min
Pumping rate	[redacted] 0.43
Head decrease	3.1
Leak>3 47 gpm?	NO
Signature	Chad Bowles

DESILTING BASIN
WEEKLY INSPECTION FORM

INSPECTION ITEM	YES	NO
Sludge De-Watering Occurring		X
Non-Meteoric Water Present 6" Above Chamber 1 Curbing		X
HDPE Liners and Concrete Sideslopes Intact	X	
Liners Attached to Curbing	X	
Curbing Intact	X	
Concrete Base Intact	X	
Water Sampling Necessary		X
Additional Chamber 1 Liner Continuity Test Required		X

Comments: Water is above cement curbing in Chambers 2 & 3

- Water pumped out on 4/15/02; Now below curbing.

INSPECTORS SIGNATURE: C. Bench

DATE: 4-13-02

KENNECOTT UTAH COPPER CORPORATION
Environmental Engineering Projects Group
8400 West 10200 South
PO Box 112
Bingham Canyon Utah 84006-0112
Phone (801) 569-7351
Fax (801) 250-6723

MEMORANDUM

March 1, 2002

To Steve Schnoor

From Marc Olesen

Subject HDPE liner repairs to Cell 212 of the Zone II Reservoir

---

A visual inspection of the primary liner in Cell 212 of the Zone II reservoir was conducted on 2-12-02 One prominent defect was noted during the inspection The defect, or leak, was the result of a contraction failure of an extrusion weld on a patch straddling a fusion seam The patch measured approximately 1 5 x 3 5 feet and was located approximately 3 5 feet above the fluid level in the reservoir at the time of the inspection The defect was approximately 5 inches in length with a ¼ inch separation at the center of the failed seam

Spark testing of all extrusion welded seams within 30 vertical feet of the fluid level in Cell 212 was completed on 2-26-02 Three additional defects were identified with the spark testing apparatus All three defects measured less than a ¼ inch in diameter and were all identified on extrusion welded seams

Repairs to the aforementioned defects were completed on 2-27-02 The repair to the larger of the four defects was accomplished by extruding a bead over the failed portion of the weld and then placing a larger extrusion welded patch over the entire patch on which the failure was noted Photographs of this process and the subsequent spark testing were obtained by Carol Johnson, EEPG, and will be forwarded to you Repairs to the three smaller defects were accomplished with extrudate overwelds

All of the repairs were tested with a spark testing apparatus and found to be acceptable

LARGE RESERVOIR - SUMP PUMP FIELD LOG

ZONE 1

SUMP 205

Date: 3 July 2001

PUMP DATA

Pump Type Grundfos

Speed Drive Setting 350 hrz

Sump water level at beginning: 2 3

Sump water level at end: 0 4

Time pump test is initiated. 10 06

Time at end of pump test: 12.36

Beginning gallons (if using Neptune flow meter) 18440 #96

Ending gallons (if using Neptune flow meter) 18930

ACTIVITY

ALR Test:_____

Sump Purge: X

RESULTS

1 Total gallons pumped. 490 gal.

2. Total pumping time: 150 min

3. Calculated pumping rate· 3.3 gpm

4 Head decrease: 1.9 ft.

5 Leak >3.47 gallons per minute? ( )Yes (X) No ALR exceeded? ( )Yes (X) No
MAH in compliance? (X)Yes ( )No

Signature Carol J. Thomas Date· 7/6/01

APPENDIX I
EXCERPTS FROM ARCO FINAL REPORT ON COPPERTON TAILINGS CLEANUP

SECTION II - PHYSICAL CONDITIONS MAINTENANCE

1.0 PHYSICAL OBSERVATION OVERVIEW

Anderson Engineering Co., Inc. (AECI) on behalf of Atlantic Richfield has performed the annual spring inspections of the Bingham Creek Channel Remediation, as required by the Bingham Creek consent decree, and in accordance with the OMP.

The annual surveillance conducted over the five years of OMP responsibility has been completed as soon as practical after the spring snow melt and runoff. The 2002 inspection of the Impoundment Site was conducted by AECI engineer Neil J. Ferrell, P.E on April 1-2, 2002. The final inspection of the Bingham Creek Channel flow control structures was completed by Mr. Ferrell on April 2, 2002. The results of these inspections and investigations along with photographs comprise the body of Section II of this Final Report. The 2002 inspection and Final Report completes Atlantic Richfield's responsibility per the OMP.

2.0 COPPERTON IMPOUNDMENT SITE

The OMP identifies the following major features of concern for the impoundment and surrounding Atlantic Richfield and neighboring properties.

- Structural condition of the impoundment.
- Condition of the composite cap.
- Condition of the confinement system.
- Condition of all surface water drainage ditches.
- Condition of the sedimentation pond and out-flow structures.
- Site roadways.
- Blending of disturbed natural slopes into the existing topography.
- Condition of groundwater monitoring wells.
- Growth of vegetation over seeded areas.
- Site security and adjoining properties.

These features are discussed in the following paragraphs.

2.1 Structural Condition of the Impoundment

The impoundment was traversed to investigate the structural condition of the engineered slopes, berms, cap and any visual signs of subsurface failure of cell construction. No visual indications of surface or subsurface failure of cell construction were observed. Elevation monuments which were established on the cap at completion of construction, were not surveyed at this inspection. A final survey was completed on October 7-8, 2002. The results of this final survey are displayed as topographic contour maps (1-3 of 3), which are found in Appendix D. The monuments, which were also checked during the final survey, show only slight settlement since construction in 1997. Total elevation change of these monuments through 2002 by cell are shown in Table 4.

TABLE 4
TOTAL GROUND SURFACE CHANGE - IMPOUNDMENT

Cell #	1	2	3	4	5
June, 1999 Monuments	5270.94	5253.49	5230.82	5210.13	5186.57
November, 2002 Survey	5270.91	5253.30	5230.74	5210.05	5186.43
Elevation Change	0.03	0.19	0.08	0.08	0.14

No erosion of surface soils due to run-off was observed during the inspection.

2.2 Condition of Composite Cap

On Cells 1 and 2, the westernmost cells, a 12" thick low permeability clay layer was installed directly above the finished grade of the tailings foundation. On Cells 3, 4,and 5, a Geo-synthetic Clay Liner (GCL) layer was installed in lieu of the clay layer, but serves the equivalent low permeability barrier purpose as the 12" thick clay layer.

During traverse of the impoundment, the physical condition of the composite cap was observed and found to be functioning as designed. It appears that the majority of potential runoff water is seeping into the top soil and excess seepage is entering the gravel/rock layer. It then flows along the designed gradient of the moisture barrier to surface ditches; flowing subsurface to the natural drain ditches. It surfaces in the constructed drainage ditches and flows from the site to the sedimentation pond. No wind or water erosion has depleted the top soil layer, exposing the gravels. None of the engineered berms have been breached by erosion or rodents. It was observed that a family of moles, and or pocket gophers have moved onto the south east area of the cap. Examination of their diggings or trails did not reveal any gravel or rock; indicating that their tunnels are only just below the surface. No evidence of deep borrowing rodents such as badgers or prairie dogs was observed during this inspection.

2.3 Condition of Impoundment Confinement System

The confinement system consists of essentially three components:

- A confining toe berm which is mainly a clay soil berm which extends from Cell 1 past Cell 5 along the north toe of the impoundment.
- A concrete crib style retaining wall structure installed along the north side of the confining toe berm along Cells 1 and 2 of the cap (this structure was installed due to property line limitations in these areas).
- Erosion protection consisting of rip-rap and a geo-synthetic cellular confinement system.

The confining toe berm is used to protect the cap from any flooding from the adjacent Bingham Creek Channel. Design considerations took into account the flow and hydraulic characteristics of the channel, which indicated that backwater could occur upstream during a 50 percent PMP storm event.

The rip-rap and cellular confinement system serve to prevent erosion of the face of the toe berm. The rip-rap was placed as infill of the cells of an HDPE cellular confinement system, which also serves to prevent sloughing of the rip-rap down the face of the berm.

The perimeter of the toe-berm that confines the impoundment base was walked and inspected. There was no visual sign of any slope slumping or toe-berm erosion, and the confining or retaining wall constructed along the Kennecott property to the north is straight as constructed (see Photos No. 1-2).

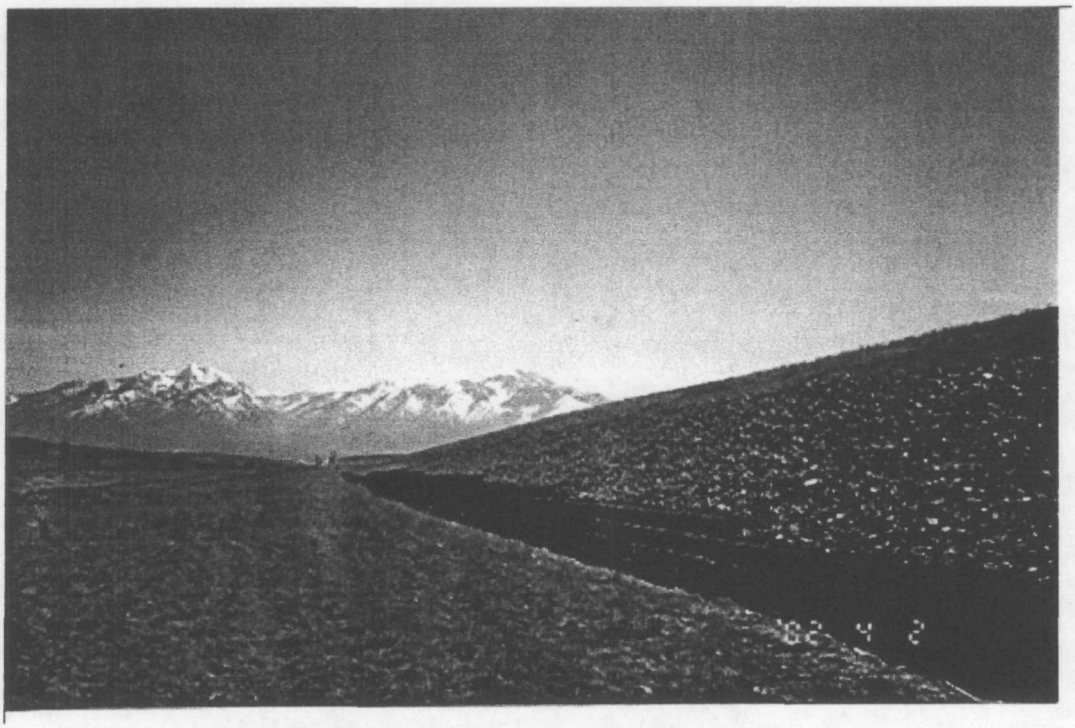


Photo1, North Toe-berm (looking east)

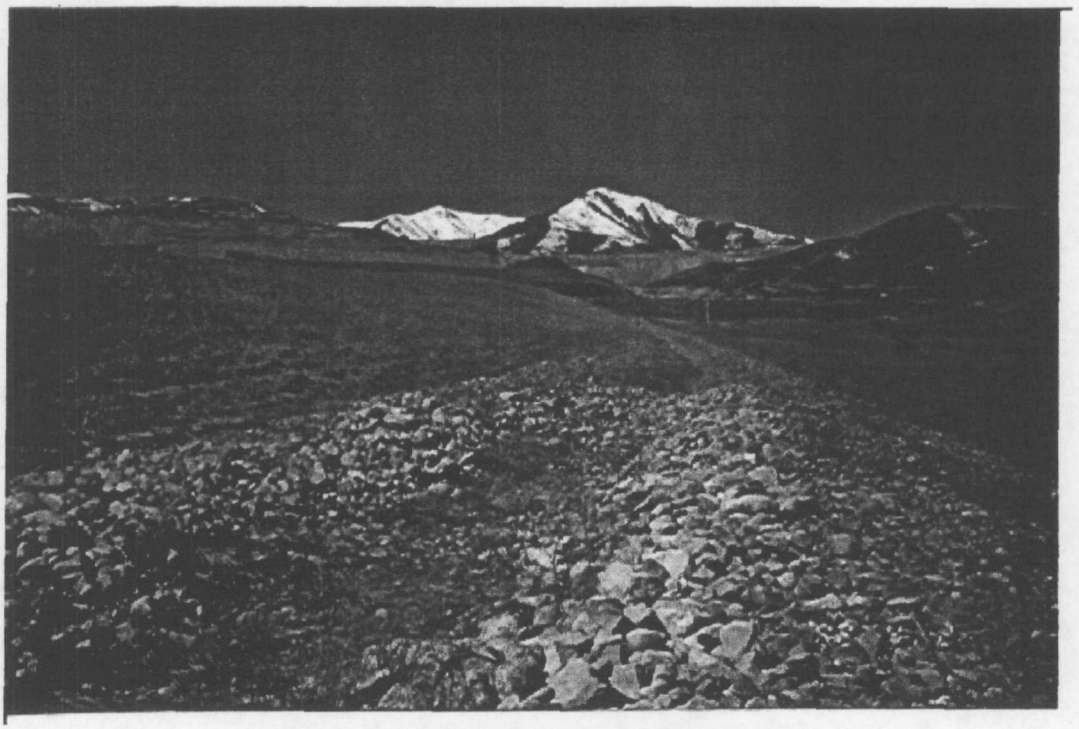


Photo 2, North Toe-berm (looking west)

2.4 Condition of Surface Water Drainage Ditches

A series of three drainage ditches collect and carry run-off away from the Composite Cap System. SD No.1 serves as the primary interception ditch of storm water runoff from the steeper side slopes. This channel is approximately 3900 feet in length and approximately 8.5 feet in width with a depth of 2 feet. It is designed with 1:1 side slopes. SD No.2W collects surface water runoff from the south facing side slopes of Cell 1, as well as runoff from the westernmost southern slope. It is approximately 950 feet long with similar cross section dimensions to SD No.1. SD No.2E collects storm water from the top 4-percent slopes of Cells 2, 3, 4 and 5, as well as from the majority of the south slopes. This channel is approximately 3400 feet long. It varies in width from approximately 13.6 feet to 16 feet after the intersection of SD No.1. It is constructed with an approximate depth of 3 feet to accommodate the additional combined flow from SD No.1.

Perimeter drainage ditches were walked and examined for channel erosion, subsidence, bank slump, silt deposits and areas of ponding. All ditches appear to be functioning as designed and no erosion, slumping or subsidence was observed. High flow appears to have been between 8-10 inches depth in the south ditch and 4-6 inches deep in the north ditch. These flows did not erode the channel or wash out the vegetation that has become established in most ditches (see Photos No. 3-5).

Photo 3, SD No. 1, North Ditch (looking east)

Photo 4, SD No. 2E, South Ditch (looking west)

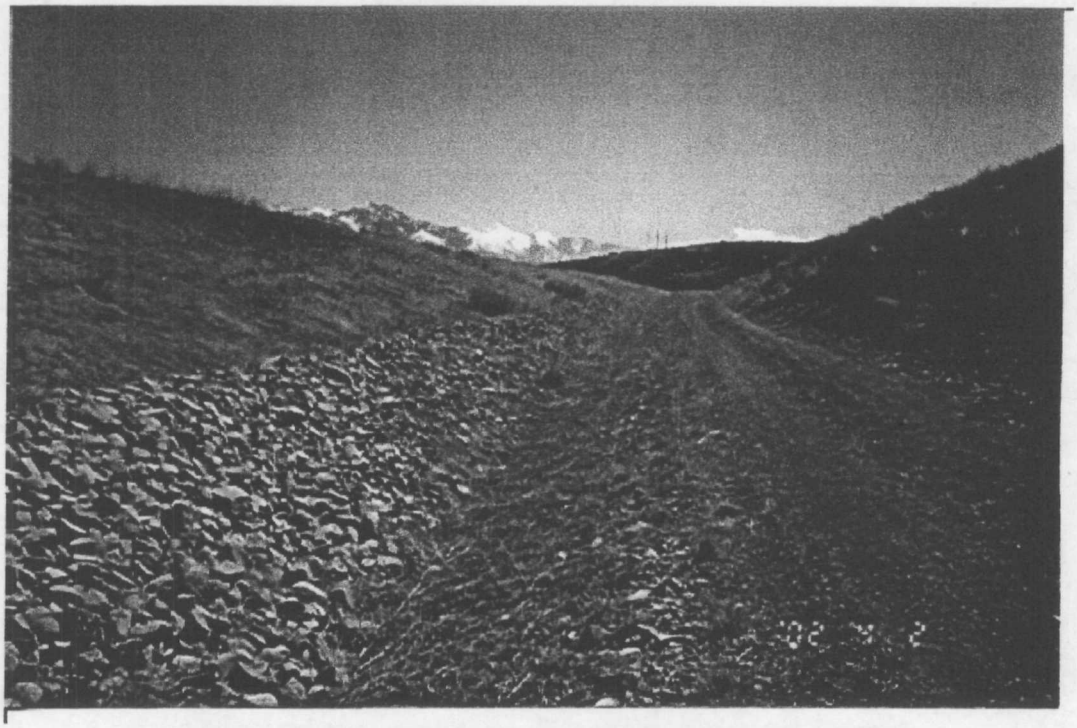


Photo 5, SD No. 2W, Southwest Ditch (looking southeast)

2.5 Sedimentation Pond and Outflow Structures

The design capacity of the existing sedimentation pond is approximately 8.4 acre-feet. At its peak capacity, the pond has an estimated depth of 11 feet and covers approximately 76,600 square feet. The estimated storage is sufficient to completely contain a 100-year, 24-hour storm event. The spillway and decant structure associated with the pond are designed to handle a storm in excess of the 100-year, 24-hour event.

Ths estimated capacity of the decant structure is approximately 105 cfs. This structure alone has the capacity to handle approximately six times the flow rate generated by the 100-year storm event.

The spillway provides a factor of safety should the decant structure become obstructed during operation. The current capacity of the spillway is approximately 60 cfs. This volume is approximately four times the flow rate generated by the 100-year storm event.

Drainage ditches carrying surface runoff water to the sedimentation pond were walked and found to be in excellent condition with considerable vegetation growth within the channel (see Photo 6).

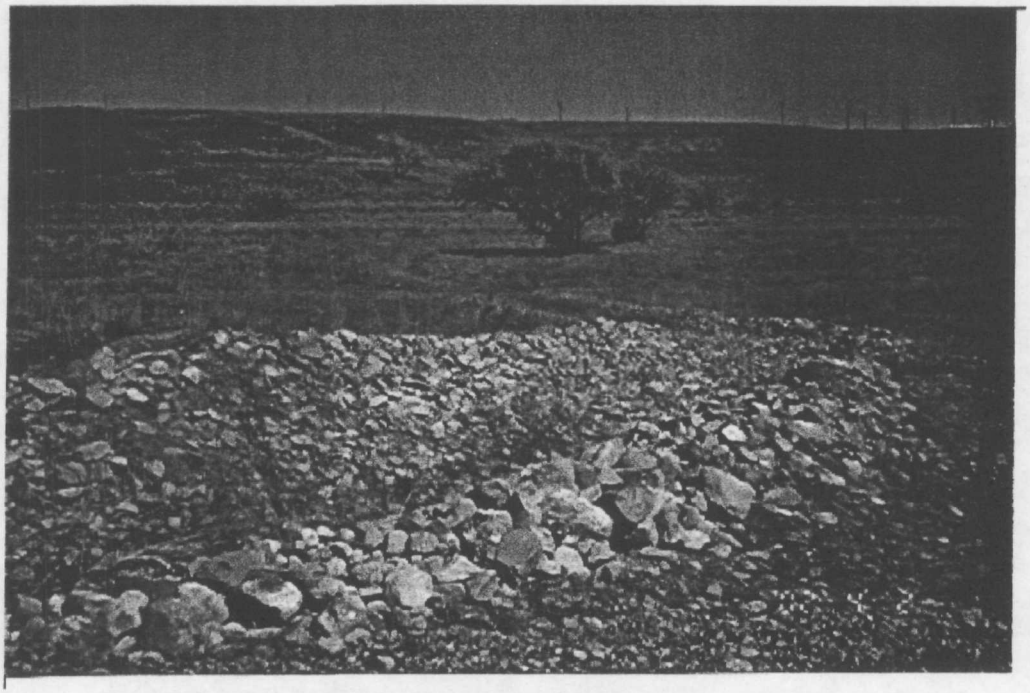


Photo 6, SD No. 2E, Drainage Ditches Leaving Impound Area

High water mark in the sedimentation pond for the year appears to have been about 3 feet depth. Pond is clean and skimmer outlet and over-flow spillway are in good shape, with no evidence that flow has ever left the pond (see Photo 7).

Photo 7, Sedimentation Pond and Structures

The outflow drainage ditch from the pond to the property line was walked and flow from local run-off from south hills appears to have been the only flow in the ditch. The sedimentation basin at the entrance to the conduit that is installed at the east property line to carry flow to Bingham Creek, was overgrown with willows and considerable debris and trash had blocked the conduit entrance. This trash and debris has been removed (see Photos number 8-9).

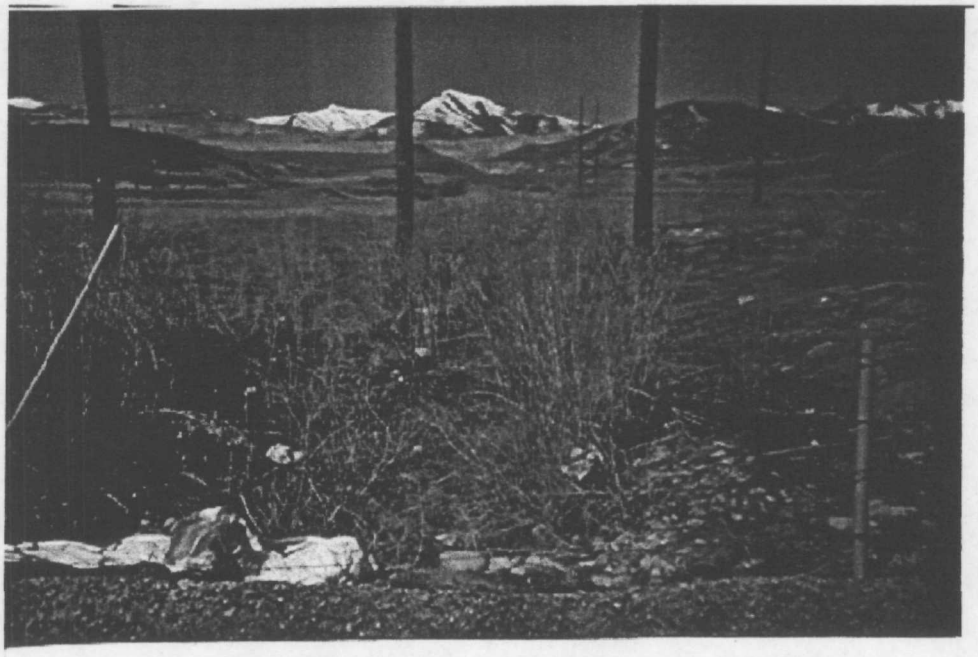


Photo 8, Sedimentation Basin at Property Line Before Cleaning

Photo 9, Sedimentation Basin at Property Line after Cleaning

2.6 Site Roadways

All constructed roadways are functioning as designed and vegetation is growing onto the roadways. No significant rutting or soft areas were found. Views of roadways can be seen in most of the photos in this section.

2.7 Disturbed Natural Slopes

As a result of removal action efforts along with Bastian Ditch, hillsides along the entire length of the southern property were left with near vertical embankments. In 1996, efforts were made to minimize erosion and potential slope failure by reworking these hillsides to achieve a 1.5:1 slope or flatter area.

These slopes were hydro-seeded in 1996. Sparse growth was achieved by the 1997 season and portions of these slopes were hydro-seeded a second time during 1997.

Areas of south hills scarred during construction of the impoundment have received seeding well and in most cases are more effectively covered with vegetation than are the natural hills. The exceptions are outcrops of dense clay strata which does not allow penetration of moisture to support growth. Some of these areas have small gullies of erosion, similar to the existing natural slopes in the area (see Photos No. 10-12).

Photo 10, Growth on Steep South Hill Borrow Area

Photo 11, Growth on South Hills (looking east)

Photo 12, Growth on South Hills Borrow Area (looking west)

2.8 Condition of Monitoring Wells

The post construction groundwater performance monitoring system consists of nine monitoring wells, located around the capped areas. They consist of three sets of paired wells, and three individual wells. The paired wells consist of one deep and one shallow well and are identified as MW4D, MW4S, MW7D, MW7S, MW10D and MW10S. The other single wells are identified as MW8, MW9 and MW11.

The purpose of the wells is to provide a means of evaluating the impact of completed removal actions on groundwater beneath the Site. The specific results associated with these wells are detailed in Section I.

The MW4 wells are located directly west of Cell 1 at or below the toe of the cells. The MW7 wells are located south and slightly above Cells 1 and 2, just south of the service road. MW8 is located north of the capped cells in the confinement system. MW9 is located between the service road and Cell 3 on the south side of the impoundment. The MW10 wells are located east of the capped areas and down gradient from them. MW11 is located southeast of the capped areas.

Final well construction, consisting of the locking well cover/monument mounted in a concrete slab and surrounded by concrete filled metal posts, was completed in 1996. All nine wells were scheduled for sampling each quarter. In some instances however, MW8 has been inaccessible to sampling personnel due to inclement weather conditions. There is no actual access road to this well. Access is normally obtained by driving light equipment along the ditch, SD No.1. Attempting this during inclement weather conditions would result in excessive damage to the impoundment side slopes.

The monitoring wells were being sampled during the site inspection and were found to be in excellent condition. Security locks on well caps are in place and functioning.

Photo 13, Monitoring Wells MW4D and MW4S

2.9 Vegetation Growth

The primary function of the vegetative cover is to stabilize the topsoil from wind and water erosion. Secondary functions include minimizing potential percolation to the tailings, creating a self-sustaining ecosystem with habitat value for wildlife, and enhancing the natural appearance of the Site. Revegetation was accomplished utilizing species compatible with the area to be restored. Grasses and shrubs characteristic of indigenous vegetation are species that have performed successfully on similar revegetation projects in the area. All of the selected species are native with the exception of Ranger alfalfa and Regreen cover crop.

Ranger alfalfa is a legume species selected as a nitrogen fixate after the first season. Because alfalfa is not a native species and tends to be aggressive, a small quantity (2 percent) was selected. Although several native varieties of legumes exist, they were not selected due to their drought intolerance.

The Regreen cover crop consists of a sterile hybrid mixture of wheat and wheatgrass. Its purpose is to provide cover during the first year while the less aggressive species become established.

Kentucky bluegrass is a species expected to occur adjacent to the Site. Canby bluegrass was selected as a substitute for Kentucky bluegrass due to its drought tolerance.

The shrub species were selected based on their shallow root systems. Antelope bitterbrush and Mountain big sagebrush, the predominant shrubs expected adjacent to the Site, typically have deep roots and are therefore not desirable species for the cap.

Cells 1 and 2 were seeded in December of 1994. Traditional broadcast seeding followed by light discing was utilized. Cells 3, 4 and 5 were seeded in the fall of 1997, utilizing "pit seeding" which had proven to be highly successful on revegetation projects in the vicinity of the Site.

At the time of this inspection, April 2, 2002, the growth seen is the dead growth from last year. However, all clumps have new growth at the base and the vegetation is spreading out from the pockets established by the pocket seeder planter. All photos show the vegetation on the site and in one more month the site will be green. During the inspection, 30 head of deer were counted. These deer stay on the site winter and summer. They prefer the mix of vegetation growing on the site to the surrounding natural hill sides. (see Photos No. 14-15).

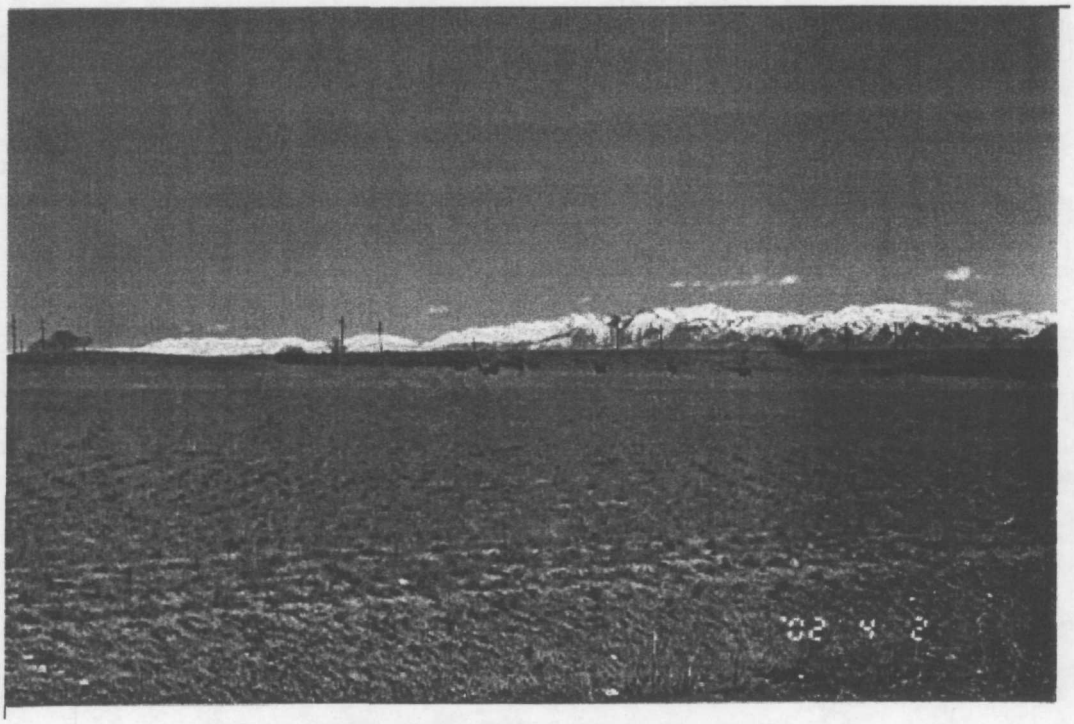


Photo 14, Deer Feeding on the Cap

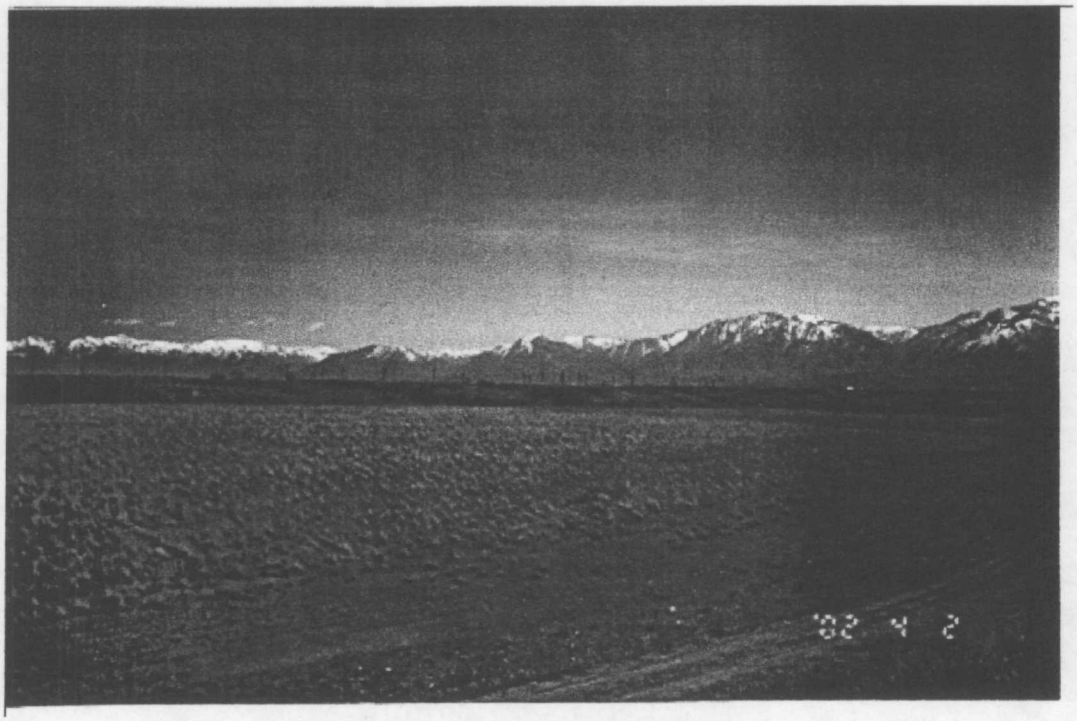
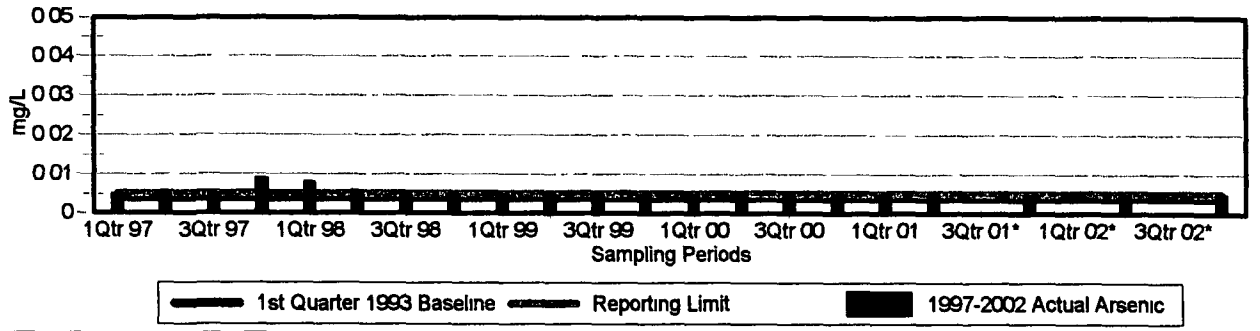


Photo 15, Cap Looking East

*Not Sampled

ARSENIC MW-4D

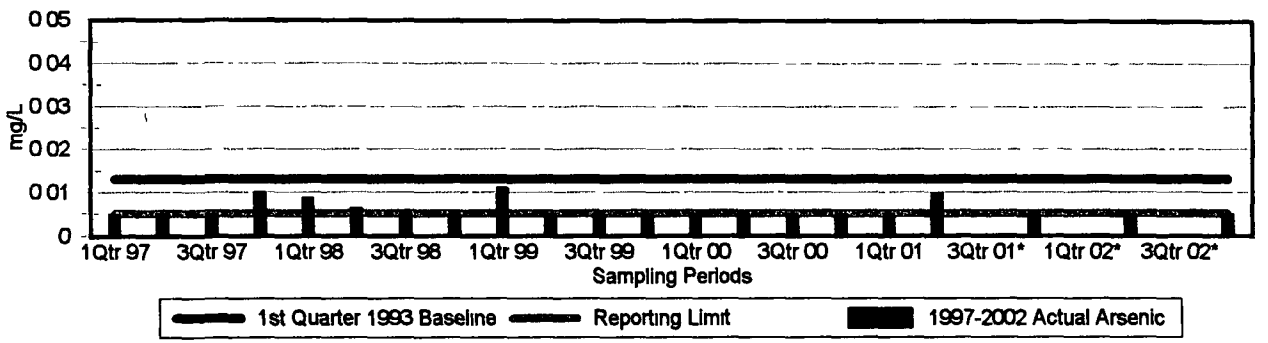
Comparison to 1st Qtr. 1993 Baseline



*Not Sampled

ARSENIC MW-4S

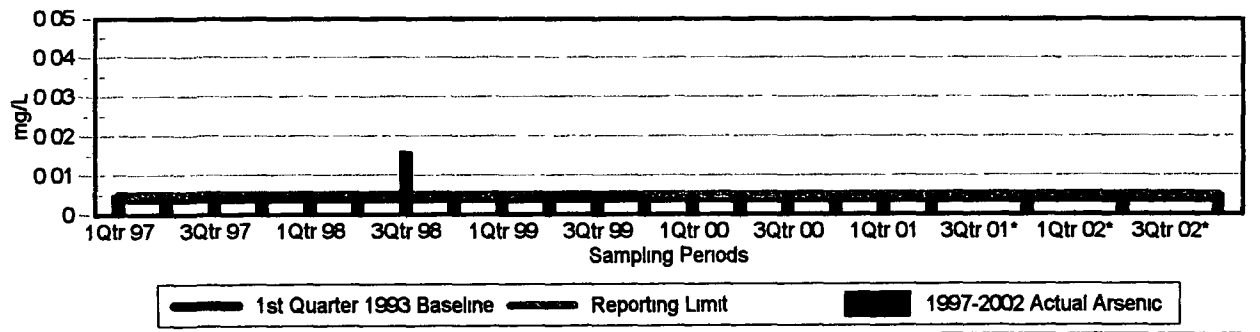
Comparison to 1st Qtr. 1993 Baseline



* Not Sampled

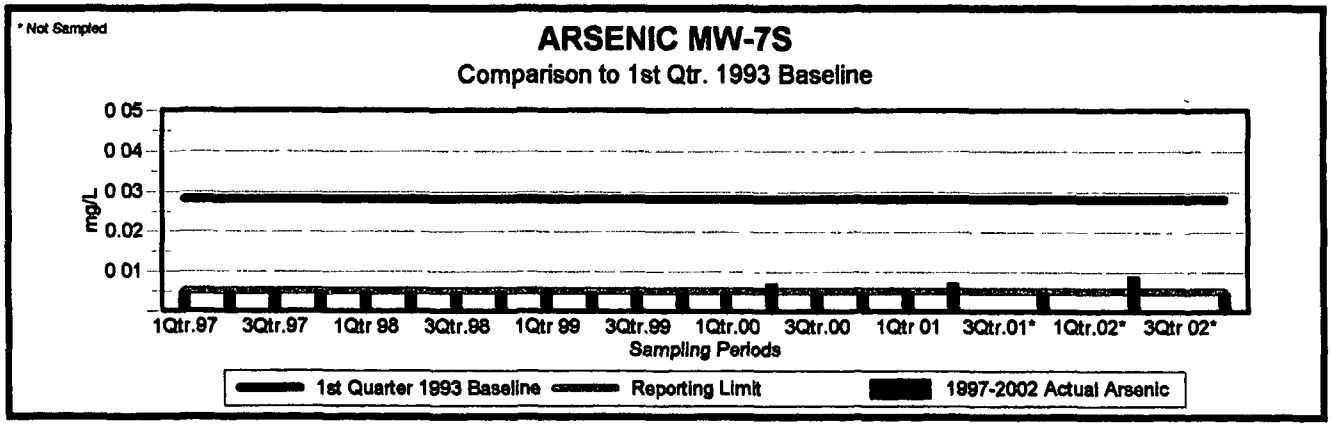
ARSENIC MW-7D

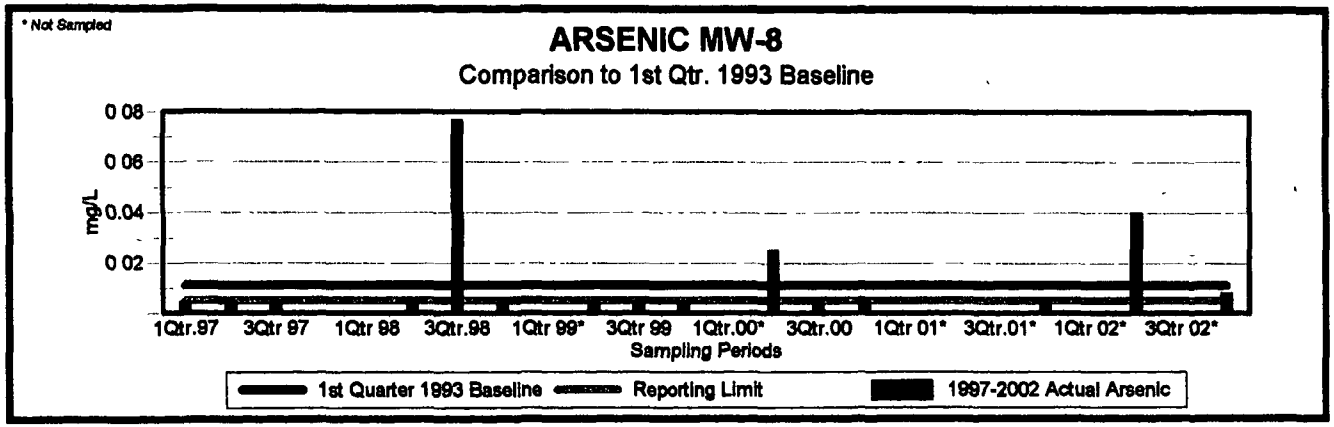
Comparison to 1st Qtr. 1993 Baseline



ANDERSON
ENGINEERING COMPANY INC

FIGURE 6J
Dec-2002





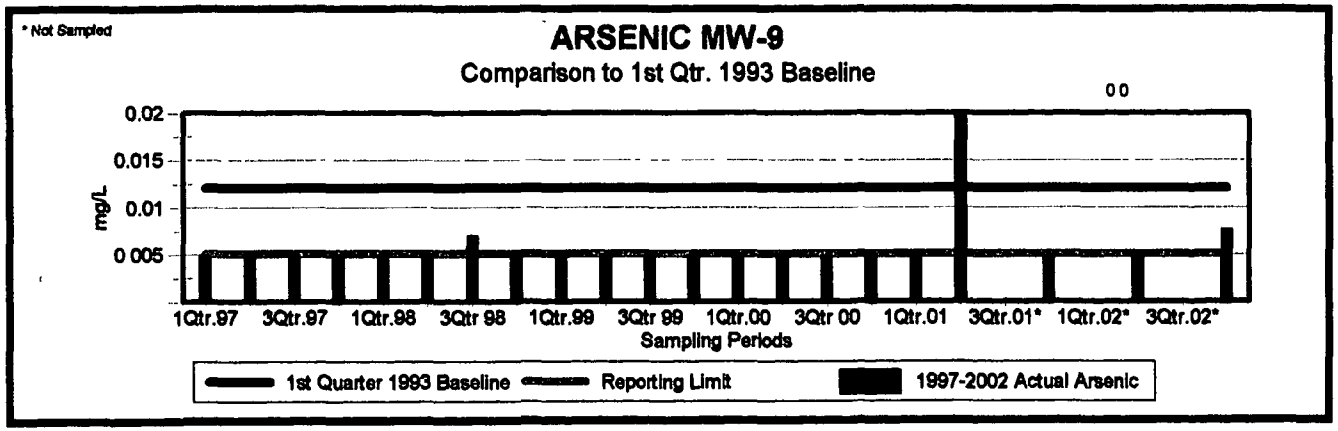


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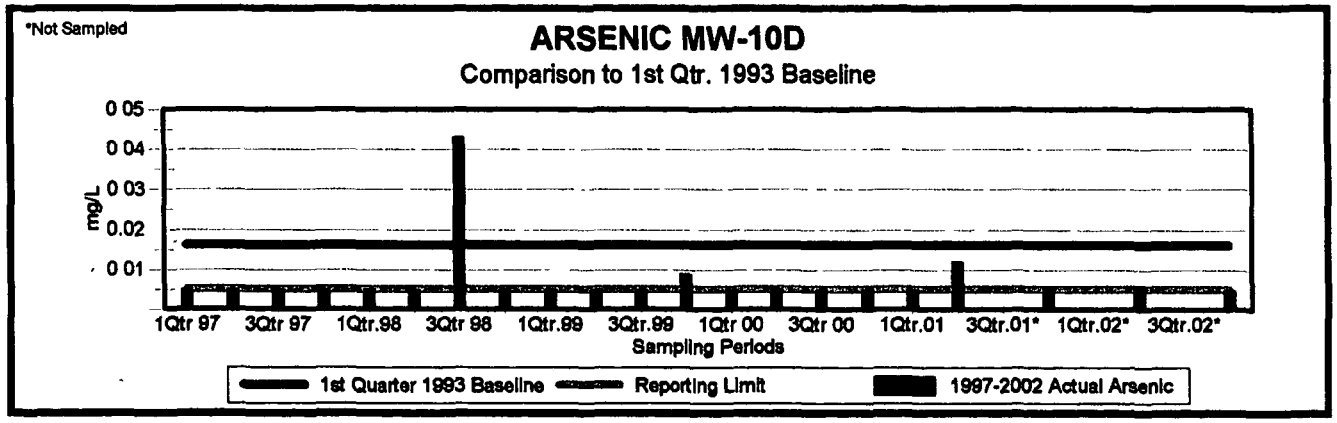
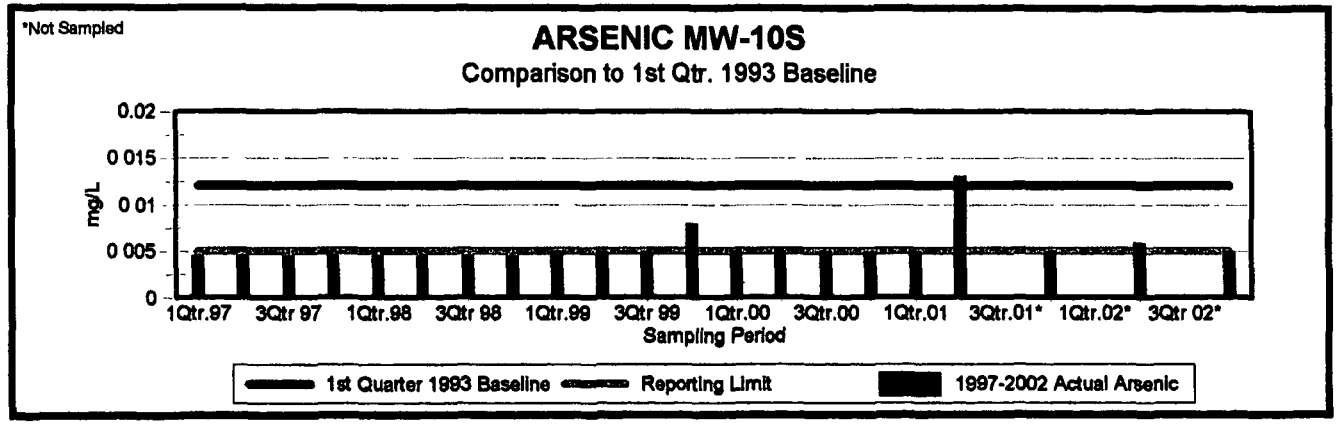
FIGURE 6K
Dec-2002





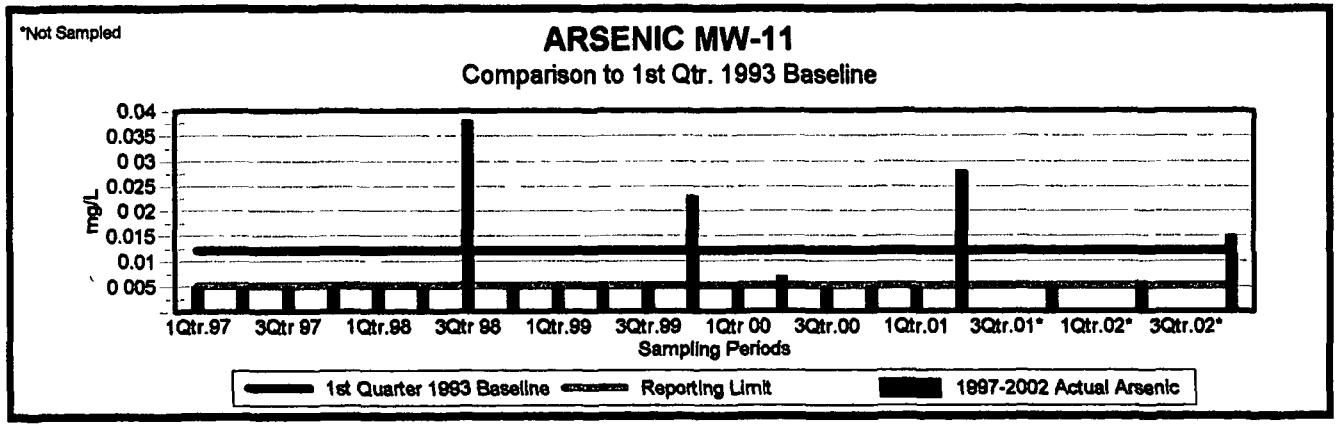


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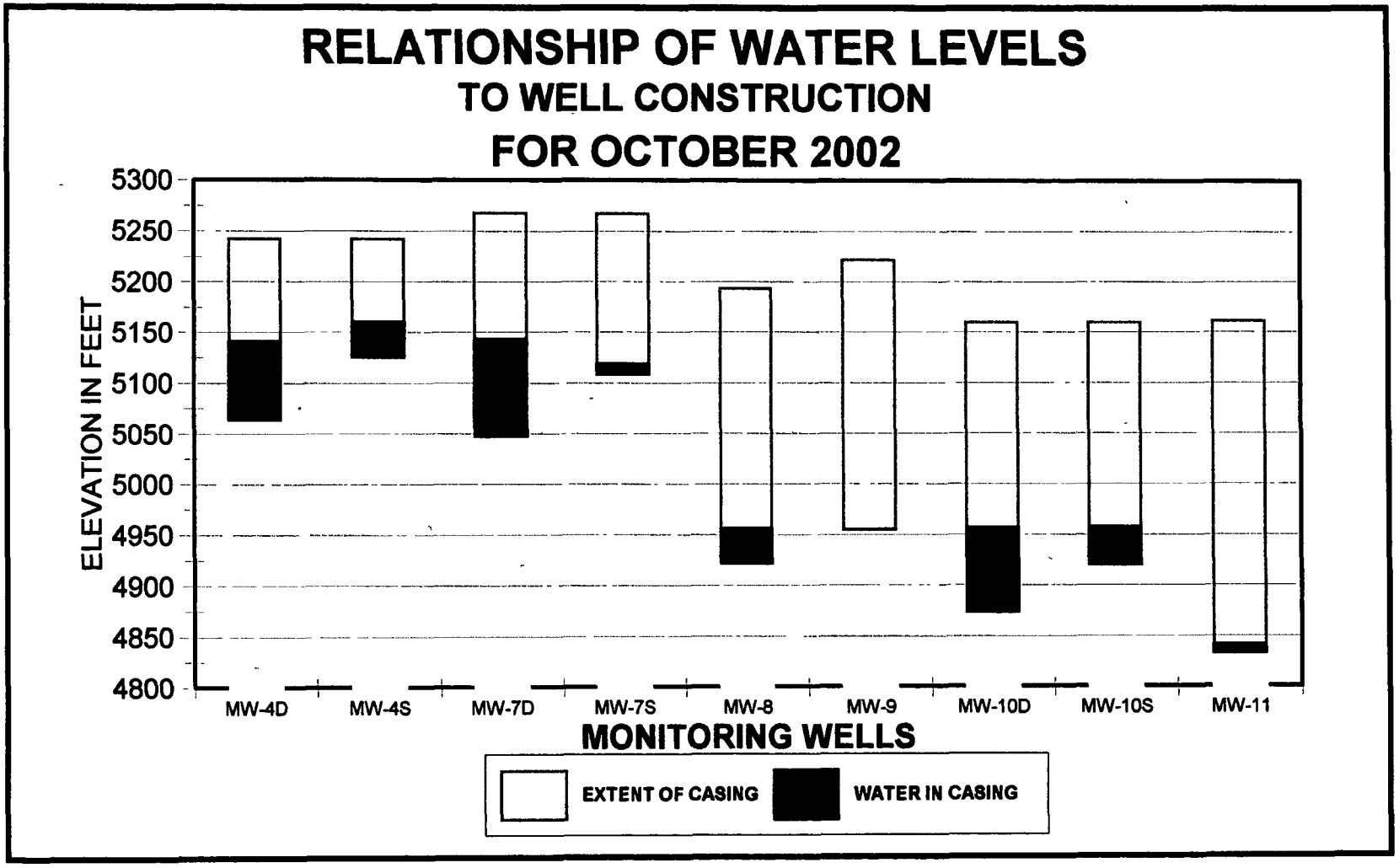
FIGURE 6L
Dec-2002

	MW-4D	MW-4S	MW-7D	MW-7S	MW-8	MW-9	MW-10D	MW-10S	MW-11
TOP OF CASING	5241.54	5242.08	5267.57	5267.18	5192.76	5221.62	5159.09	5159.35	5160.91
WATER LEVEL	5140.64	5160.08	5142.67	5118.38	4955.96	4954.82	4956.49	4956.95	4840.61
BOTTOM OF CASING	5060.12	5122.06	5042.93	5104.43	4917.85	4950.81	4869.63	4916.22	4828.85



Green indicates the Top of Casing from which the depth to water is measured.
Blue indicates the elevation of the phreatic surface relative to the top of casing.
Top of Casing elevations are field surveyed elevations. Diagram shows relative sampling zones based on construction.
NI=No Information Available

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FIGURE 5
Dec - 2002